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NASA-CR-1676 15

TOXICITY OF THERMAL DEGRADATION PRODUCTS OF SPACECRAFT MATERIALS



Report to

NASA JOHNSON SPACE CENTER

HOUSTON, TEXAS 77058

Contract Number

ち、NAS 9-15670

Period Covered by Contract

November 10, 1980 to May 9, 1982

Date of Report

1. May 7, 1982

Report Prepared by

W.H. Lawrence, Ph.D.
Associate Director and

Head, Animal Toxicology Section

Report Submitted by

John Autian, Ph.D., Director Materials Science Toxicology

Laboratories

University of Tennessee Center for the Health Sciences

Memphis, Tennessee 38163

Note! The contract specifies separate reports for materials tested under the spacecraft and aircraft procedures. This year, however, all materials submitted for evaluation were for the same (aircraft) testing protocol, as modified.

(NASA-CR-167615) TOXICITY OF THERMAL DEGRADATION PRODUCTS OF SPACECRAFT MATERIALS Final Report, 10 Nov. 1980 - 9 May 1982 (Tennessee Univ.) 138 p HC AC7/MF AU1

N82-27964

Unclas 28319

CSCL 06T G3/52

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May 7, 1982

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Abstract

Three polymeric materials were evaluated for relative toxicity of their pyrolysis products to rats by inhalation. These materials were: Y-7683 (LS 200), Y-7684 (Vonar 3 on Fiberglass), and Y-7685 (Vonar 3 on N W Polyester). Criteria employed for assessing relative toxicity were (1) lethality from in-chamber pyrolysis, (2) lethality from an outside-of-chamber pyrolysis procedure [MSTL Procedure], and (3) disruption of trained rats' shock-avoidance performance during sub-lethal exposures to in-chamber pyrolysis of the materials.

The relative toxicity, based upon lethality, from in-chamber pyrolysis of these materials was: Y-7685 > Y-7684 > Y-7683. While the approximate LD $_{50}$ for Y-7684 and Y-7683 was the same at 14 days, deaths occurred sooner after exposure with Y-7684 than with Y-7683.

The relative toxicity, based upon lethality, from the MSTL pyrolysis procedure ranks the materials as: Y-7684 > Y-7685 > Y-7683.

The relative toxicity, based upon detrimental effect to conditioned-avoidance performance of rats exposed to pyrolysates (in-chamber pyrolysis method) of these materials, would rank these samples as: Y-7684 > Y-7685 > Y-7683.

Introduction

This work is a continuation of previous studies to assess the relative toxicity, as expressed by lethality and alterations in trained (conditioned) behavior, to rats of pyrolysis/combustion products of spacecraft materials. While the experimental design still emphasizes the role of carbon monoxide in the overall pyrolysate toxicity (by analysis of exposure chamber atmosphere for carbon monoxide concentration and determination of percent carboxyhemoglobin in rats dying in the chamber), the changes in conditions for pyrolysis/combustion (to an in-chamber thermodegradation) of test samples prevents direct comparison of these toxicity data with much of the data contained in previous reports.

The pyrolysis/combustion process can apparently exert a significant influence upon the absolute toxicity, and probably upon relative toxicity, of the pyrolysis/combustion products produced. Some of the previous toxicity data obtained from spacecraft materials utilized a controlled slow heating rate for thermodegradation outside the exposure chamber, and continuous air-flow through the chamber during pyrolysis and post-pyrolysis exposure (the MSTL procedure). The theoretical rationale usually stated in support of in-chamber pyrolysis/combustion is based upon the concern that some toxicity is lost due to condensation/precipitation of some thermodegradation products from external pyrolysis/combustion prior to entering the exposure chamber. If this were true, then there would be a reduction in the observed toxicity from such externally produced pyrolysis/combustion products when compared to in-chamber pyrolysis.

An earlier report (1) presented toxicity data from a limited number of samples that were evaluated both by in-chamber pyrolysis procedure and by the MSTL procedure (as mentioned above). Although it was apparent that condensates did occur prior to entrance of pyrolysates into the exposure chamber, lethality data did not support the concept that these "high boiling" condensates significantly contributed to the lethality of the pyrolysis/combustion products. The data, in fact, indicated the pyrolysis/combustion products produced by the MSTL (outside of chamber) procedure were more toxic than those produced by the in-chamber method in every instance where there was comparible data. This phenomenon might be due to the formation of different gaseous products by the slower rate of thermodegradation (by the MSTL method) and/or a longer exposure period (used in the MSTL procedure).

The in-chamber thermodegradation procedure used in the current study does not permit the slow rate of degradation, as used in the MSTL procedure, because of (a) the need to prevent excessive temperatures (i.e., no greater than 35°C) within the animal exposure chamber, and (b) the fixed volume of air (i.e., static environment during pyrolysis and subsequent exposure) contained in the animal exposure chamber may produce hypoxia in the experimental animals (independent of pyrolysate toxicity) as a result of longer sojourns of animals in chamber, coupled with depletion of oxygen by pyrolysis/combustion of the test samples.

W.H. Lawrence and John Autian, "Toxicity of the Pyrolysis Products of Spacecraft Materials", Annual Report to NASA Johnson Space Center, July 25, 1978, p. 45.

The preceding discussion should be kept in mind in evaluating the subsequent data. These comments may also help to understand why it was sometimes necessary to conduct the experiment or test in a particular manner.

Purpose of Work. The primary objective of this work was to obtain information about the relative toxicity of thermodegradation (pyrolysis/combustion) products of spacecraft materials supplied by the Technical Monitor. The primary procedure used was an inchamber pyrolysis of the sample to determine its lethal potential, and then to examine the effects of the pyrolysates upon operant conditioned behavior of trained rats from sub-lethal exposures. At the request of the Technical Monitor, lethality of pyrolysates from these samples was also determined by the MSTL procedure. The lethal activities of the pyrolysis/combustion products were evaluated based upon the acute lethality of rats from inhalation of these pyrolysates. Post-exposure observation of the rats, coupled with histological evaluation of selected organs, serve to screen the materials for significant delayed toxic reactions resulting from inhalation of their pyrolysis/combustion products. Also, determination of carbon monoxide concentrations in the chamber atmosphere during exposure, and percent carboxyhemoglobin in animals expiring in the chamber, provide some basis for assessing the importance of carbon monoxide as a toxicant in the pyrolysis/combustion mixture. Oxygen concentrations in the chamber were also measured to ensure hypoxia was not the cause of death.

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Materials and Methodology

Materials. The code designations and description of the test

samples, as supplies by the Technical Monitor, included in this study are presented in Table 1. Also included in this table is the approximate temperature necessary for thermodegradation of each sample and the percent of the sample which is expected to be pyrolyzed. This information is based upon TGA data.

Method of Sample Pyrolysis/Combustion - In-Chamber Pyrolysis

Procedure. All samples were pyrolyzed/combusted directly into the rat exposure chamber [198 liter (0.2 M³)] using an electric furnace, and all products mixed thoroughly with the chamber atmosphere by an electric fan located inside the exposure chamber. An experimental constraint which influenced pyrolysis/combustion of samples was that of chamber temperature, i.e., the chamber temperature was not to exceed 35°C (95°F). To accomplish this, the sample was pyrolyzed rapidly (~10 minutes) at 700-800°C and the furnace removed from the chamber to reduce added heating of the chamber atmosphere from the furnace as it was cooling (i.e., after thermodegradation).

The furnace contains heating elements embedded in a high temperature ceramic type material which were located in the bottom and four sides of a rectangular chamber 3" x 3" x 5". These heating elements have a maximum temperature rating of 1,200°C, thus exceeding the 1,000°C capability which we desired. A removable stainless steel rectangular cup, with internal dimensions of 2.5" x 2.5" x 4.5", was constructed to fit closely inside the space formed by the heating elements. Since this furnace requires a considerable time to pyrolyze a sample starting at room temperature, pyrolysis was accomplished by pre-heating the furnace (outside of the chamber) to about 700-900°C, then

placing the stainless steel cup (containing the test sample) in the furnace opening, and immediately placing the furnace and sample in position to pyrolyze the sample directly into the rat exposure chamber. When pyrolysis was completed the furnace was removed from the exposure chamber to prevent additional heating of the chamber atmosphere by radiation from the furnace. The time required for thermodegradation, and the increase in chamber temperature, varied depending upon sample and quantity of sample. In most cases, however, this could be accomplished and still maintain the chamber temperature less than 35°C (95°F). An advantage to this system is that it permits relatively accurate determination of sample residue.

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MSTL Procedure. Four male rats in small individual cages were placed in the rectangular, glass-walled exposure chamber (volume = approximately 64 liters). The chamber was equipped with an external light for illumination, an internal YSI thermister probe for monitoring chamber temperature, and a magnetically-driven fan to prevent air stagnation and layering of pyrolysis products. The test sample was placed in a Vycor tube inside a programmed electric furnace, with a thermocouple adjacent to the sample which controls heating of the furnace. One liter per minute of air was introduced at the end of the Vycor tube, passed over the pyrolyzing sample and into the exposure chamber. Prior to the pyrolysate entering the inhalation chamber, 0.5 liter/minute of fresh air was added to the effluent. The furnace was heated at 10°C/minute until it reached the temperature of maximum decomposition (as determined by TGA data) plus 50°C. At this point, the furnace was turned off and air-flow continued for an additional 60

minutes; then the chamber was opened and the animals removed.

A gas sampling port was located immediately upon exit of the fumes from the inhalation chamber prior to their being exhausted.

COHb Determination. Carboxyhemoglobin determinations were conducted spectrophotometrically, using a modification of the method of Commins and Lawther (2). Earlier experiments with this and other methods indicated that excessive dilution of the blood prior to analysis yielded lower calculated percentages of COHb in the blood; presumably this is due to dissociation of COHb in the dilute solution (COHb \rightleftharpoons CO + Hb). Thus, the modifications employed were to permit spectrophotometric analysis without undue dilution of the blood sample. The Commins and Lawther method was used with the following modifications: (a) 40 μ l of blood (rather than 10 µl) was used per 10 ml of reagent (rather than 25 ml), and (b) a cell path of 0.1 cm (rather than 1.0 cm) was employed. Thus, the solution for analysis was 10 times more concentrated, and the cell path for analysis was one-tenth that recommended by Commins and Lawther. Analyses were performed at a wavelength of 420 nm, with readings at 414 and 426 nm for purposes of correction. Concurrent COHb and O2Hb controls were tested, in which the rat's blood was saturated with gas from tanks of CO and O_2 , respectively.

Thermogravimetric Analyses (TGA). The thermodegradation

²B.T. Commins and P.J. Lawther, "A Sensitive Method for the Determination of Carboxyhemoglobin in a Finger Prick Sample of Blood". Brit. J. industr. Med., 22:139-143 (1965).

characteristics of each sample were determined in air and nitrogen. This provided general information about the temperature required to initiate degradation, to complete degradation, expected percent degradation, and some indication of the importance of oxidative processes for degradation.

 ${\tt ED_{5.0}}$ Determinations. The lethality of each sample was determined by pyrolyzing specific weights of sample and exposing a group of 4 male Sprague-Dawley rats to the pyrolysates for 30 minutes after completion of pyrolysis of each sample weight. LD50s were calculated for the samples based upon chamber deaths, deaths occurring within 48 hours, and those occurring within the 14-day post-exposure observation period. The chamber atmosphere was analyzed for selected gases by use of gas detector tubes or gas chromatography, or both. Carboxyhemoglobin (COHb) levels were determined in rats which died in the chamber. Animals were autopsied when they died, or were sacrificed after 14-days, and tissues from most of these preserved in buffered formalin, and subjected to histopathologic evaluation. The actual LD50, expressed as initial weight of sample, which when pyrolyzed by this method would kill 50% of exposed rats, was calculated by Cornfield and Mantel's modification of Karber's method (3).

Behavioral Studies. The subjects were adult male Sprague-Dawley rats (about 275-325 gm), which were identified by color and cage number and housed individually in stainless steel cages. They had free access

³J. Cornfield and N. Mantel, "Some New Aspects of the Application of Maximum Likelihood to the Calculation of the Dosage Response Curve", American Statistical Association Journal, 45: 181-210 (1950).

to fresh tap water and laboratory rat chow. The behavioral apparatus (shock chamber) was approximately 7.5 x 9.5 x 7.75 inches, with a Gerband lever mounted in one end. The floor and two sides of the shock chamber consisted of 1/16" diameter stainless steel rods, mounted about 0.5 inches apart, and connected to a shock source and shock scrambler. This shock chamber was placed inside the inhalation exposure chamber used in the $1.D_{50}$ studies, which has a volume of approximately 200 liters (198 liters).

The rats were trained on a Sidman avoidance schedule, with a shock-shock interval of 5 seconds, and a response-shock schedule interval of 20 seconds. The shock duration was 0.5 seconds, with an intensity of 1.3 milliamps. Thus, if the rat did not press the lever at all, he would receive 12 shocks/minute, but appropriate lever presses would permit complete avoidance of shocks. During training, each rat was placed in the apparatus for one hour per day. When the average number of shocks an animal received during the hour was 2.5/minute or less, and the response rate was stable for 2 consecutive days, he was considered for use as a test subject. This usually occurred in about 2 weeks and animals that failed to reach this criterion were rejected from the study.

After training, the first stage of testing consisted of two 70 minute sessions held on two consecutive days (Days 1 and 2), during which cumulative shock avoidance rates were monitored every 10 minutes. If, during the first session, a subject's rate of avoidance decreased so that he received an increased number of shocks over any 20 minute period, he was returned to the training conditions until his performance was stabilized. He was then retested. The purpose of these sessions was to obtain a reasonably

stable baseline measure against which the performance on the day of pyrolysis testing could be assessed.

On the day of pyrolysis testing, the rat was placed in the behavioral apparatus and a 30-minute control performance was obtained. If the rat's avoidance performance was adequate and reasonably stable during this time, this was used as a pre-burn control (or response for the pre-burn period) and the experiment was continued. However, if the rat's avoidance behavior was inadequate or very unstable, the sample was not burned, and the rat was returned to training or discarded. If this pre-burn control was satisfactory, the chamber door was secured and the designated sample was pyrolyzed/combusted in the chamber. The animal's shock-avoidance performance during pyrolysis/combustion was recorded, and at 5 minute intervals for the ensuing 30 minutes while the inhalation chamber remains closed.

The pre-burn control period was a minimum of 30 minutes, and frequently a little longer; the duration of pyrolysis/combustion was about 10 minutes (8-15 minutes) depending upon the sample. The maximum temperature in the chamber was kept from exceeding 35°C (95°F). In each instance, the rat's performance was monitored and recorded for at least 30 minutes after completion of pyrolysis/combustion.

As a basis for comparison of "equivalent" non-lethal exposures, one half ($\frac{1}{2}$) of the LD₅₀ sample weight was chosen as the basis for comparison. Because of the lack of a chamber LD₅₀ for two samples and the rough approximation obtained for the 14-day LD₅₀, various quantities of samples were pyrolyzed for the behavioral evaluation; at least one of which approximated one-half of the LD₅₀. Each sample material was tested by exposing four

trained rats to its pyrolysate. Assignment of a particular rat to a specific sample and order of testing was semi-random, determined by appropriate information about the sample, the trained rats available, and the needs for obtaining a block of tests for the sample. Each rat was exposed to a pyrolysate of only one sample (experimental run).

Results and Discussion

Thermogravimetric Analyses (TGA). Computer plots of the thermal stability/thermodegradation of these materials are shown in Figures 1-6. A summary analysis of each of these plots is presented in Table 2. Although none of these sample material were completely degraded at temperatures between 900°C and 1,000°C, thermal degradation of the samples appeared to cease at a temperature of 600°C or less.

Lethality Studies. Tests were conducted by both the inchamber pyrolysis procedure and the MSTL procedure to assess the relative lethality of pyrolysates from these test samples. The initial sample weights, which when pyrolyzed according to their respective procedures, required to kill 50% of the exposed animals (i.e., LD_{50}) and their respective 95% confidence intervals, are presented in Table 3 for both the In-Chamber Pyrolysis and MSTL Procedures. This table shows the LD_{50} values for chamber deaths, deaths within 48 hours of exposure, and deaths within 14 days of exposure.

For the in-chamber pyrolysis it was not possible to obtain an LD_{50} for chamber deaths for samples Y-7683 and Y-7684 using up

to 50 and 56.57 gm of sample, respectively. The size of the pyrolysis cup would not permit pyrolysis of significantly larger quantities of the samples. Only one rat died within 48 hours after removal from the inhalation chamber after exposure to pyrolysate from sample Y-7683, with most deaths coming several days after exposure. On the other hand, all of the deaths from Y-7684 occurred within 48 hours after exposure. Sample Y-7685 produced a more ideal pattern of deaths, and all of these occurred in the chamber. Thus, it was possible to obtain a good LD50 value for Y-7685, but the values obtained for the other two samples by this procedure must be considered as approximations. Table 4 summarizes the cumulative mortality pattern obtained from in-chamber pyrolysis of the three samples. The test data utilized to calculate the LD_{50} are indicated in this table; constraints imposed by the Karber's method of LD₅₀ calculation prohibit use of all of these data.

Table 5 presents a summary of lethality data obtained by the MSTL pyrolysis procedure, and indicates those employed in calculation of the LD_{50} for these three samples. It will be noted in this case, all deaths occurred in the chamber. And, as mentioned earlier for prior comparison of toxicity from in chamber vs. outside of chamber pyrolysis, none of these samples were more toxic when pyrolyzed in the chamber, than when pyrolyzed outside the chamber with the pyrolysates flowing into the chamber.

To facilitate comparisons of relative toxicity of the test materials and the two methods of pyrolysis-exposure, Table 6 summarizes and extrapolates data contained in Tables 3, 4 and 5,

to remove differences of percentage pyrolyzed by presenting the $LD_{50}s$ in terms of the quanity of sample pyrolyzed rather than initial sample weight, and then removes differences in chamber size by calculating it in terms of per liter and per cubic meter.

The concentrations of selected gases in the exposure chamber during the LD_{50} determinations from the in-chamber pyrolysis procedure are summarized in Table 7, and for the MSTL procedure in Table 8. The results of histological examination of selected tissues of rats dying during exposure to pyrolysates during the 14-day observation period, or which were sacrificed at the end of the 14-day observation are tabulated for the in-chamber pyrolysis procedure in Table 9, and for the MSTL procedure in Table 10. Histopathologic findings from some untreated control rats are presented in Table 11. Brief summary descriptions of observed histological features which, in the opinion of the pathologist were likely related to pyrolysate exposure, along with a summary description of gross autopsy observations, are contained in Table 12 for the in-chamber pyrolysis procedure and in Table 13 for the MSTL procedure.

As indicated previously, it was not possible to calculate an in-chamber LD 50 for samples Y-7683 and Y-7684 when the material was pyrolyzed in the exposure chamber, although quantities of 50 gm or more were pyrolyzed (see Table 4). All delayed mortalities from exposure to pyrolysates of Y-7684, however, occurred within 48 hours post-exposure. On the other hand, only one of the ten delayed deaths seen with Y-7683 occurred within 48 hours following exposure; most of the deaths occurred between the 7th

and 11th post-exposure days, with one on the 5th day and another on the 14th day. Although the estimated 14-day LD_{50} is the same for these two samples (Y-7683 and Y-7684), the mortality pattern is dramatically different.

An interesting response occurred when behavioral tests were initiated with sample Y·7684, and to a lesser extent with Y-7683. Although determination of the LD $_{50}$ s for these samples yielded only a rough approximation, when behavioral tests were initiated with quantities of sample which were well below that required for chamber deaths in the LD $_{50}$ studies, a number of rats died in the chamber or immediately after removal. [Histopathologic examination of tissues from two behaviorally trained rats that died from exposure to pyrolysates of Y-7684 is presented in Table 14.] Initially, we thought this was due to some experimental error in obtaining data for the LD $_{50}$. We began to repeat the LD $_{50}$ determination for Y-7684, but this gave no new information since the repeated data was comparable to the initial data.

A few pilot tests were performed to examine this unusual response. Since the rats used in the behavioral studies were typically older and heavier than those used for LD_{50} determinations it was decided to see if this might be responsible for the unexpected mortalities. Two experiments were conducted in which three untrained rats of the size used in LD_{50} studies, were put in the shock chamber (with the shock-avoidance lever disconnected) and placed in the pyrolysis-exposure chamber. Table 16 shows the data obtained when 20 grams of Y-7684 were pyrolyzed into

the chamber while the rats were receiving the same shock used in the avoidance procedure; all six of these rats died in the chamber. (It might be pointed out that pyrolysis of up to 56.57 gm of this sample had failed to produce any chamber deaths in the LD $_{50}$ studies.) Table 14 shows the histopathology for 5 of these 6 rats exposed to the pyrolysis products while receiving shocks.

As shown in Table 17, five additional experiments were performed in which 15 or 20 gm of Y-7684 was pyrolyzed with 4 rats in the exposure chamber, 2 of which were in the shock box and 2 were not. In the first trial where 15 gm of Y-7684 was pyrolyzed, the two rats receiving the shock died in the chamber, while the two not receiving the shock survived the chamber exposure and the 14-day post-exposure observation period. In the second trial with the same material and quantity, one of the two rats receiving shock died in the chamber and the other died within 48 hours, but neither of the two rats not receiving shock died. Thus, these data suggest a synergistic (potentiating) effect upon lethality between the sub-lethal shock and sub-lethal pyrolysate exposure.

Although this phenomenon was first brought to our attention by death of some of the rats in the behavior studies which were exposed to 20 gm of Y-7684, similar paired (2 rats receiving shock during exposure and 2 rats not receiving shock) tests with pyrolysis of 20 gm samples did not provide such clear-cut evidence (see Table 17). In the first trial none of the animals died within 48 hours; the other three rats surviving the entire 14-day post-exposure period. The second trial resulted in all

4 rats dying in the chamber. The third trial did not produce any chamber deaths, but one rat receiving the shock and one without the shock died within 48 hours; the other two survived the 14-day observation period. Histopathologic evaluation of tissues from most of these rats is presented in Table 14.

With the exception of data discussed in the preceeding paragraph, the accumulated results (including death of some rats during behavior testing which are not tabulated in this report because death occurred so early no behavioral data, from exposure to sub-lethal pyrolysates of the material were included) strongly suggest an increase in toxicity (lethality) of the pyrolysates from Y-7684 when this is combined with a sub-lethal electric shock (or the stress resulting therefrom). If this increased toxicity is real, and most data support the assumption, one can only speculate at this time what the mechanism of action may be. Some of the possibilities include: (1) a component of the pyrolysate may sensitize the heart to endogenous hormones (e.g., adrenaline) released during the trauma/stress of the shock; (2) critical areas of the brain may be sensitized by a component of the pyrolysate which make them more sensitive to CO, HCN, or other toxicant present at (otherwise) non-lethal levels; or (3) an interaction between some pyrolysis product and other shock-induced internal hormonal or metabolic disturbances not noted in the absence of the shock. Initially, the possibility of prolonged stress, from shock-avoidance training, was considered as a likely alternative explanation, but the chamber deaths which occurred with untrained rats would tend to decrease the probability of this being the explanation.

Behavioral Studies. In the ensuing discussion the samples are identified by code numbers; these are presented in Table 1. Because of the lack of good LD_{50} values for two of these samples by in-chamber pyrolysis, as indicated previously, three or four initial sample weights of the samples were utilized in the behavioral studies, one of these was (or approximated) one-half of the sample's LD_{50} .

Definition of terms. In the discussion, Day 1 refers to the first of two pre-test days of behavioral activity, and Day 2 refers to the second of the two pre-test days of behavioral activity. Day 3 is the day on which the pyrolysis-behavioral test is performed. Day 3 may be subdivided into 7 time intervals of 10 minutes each; interval 1, 2 and 3 represent the 30 minute control performance of the rat prior to pyrolyzing the test sample in the chamber. Interval 4 is the period during which the sample is pyrolyzed. Intervals 5, 6 and 7 are the three 10-minute post-burn (post-pyrolysis) periods during which the animal's behavior is scrutinized to see if there are changes in the animal's performance (response). Comparisons of time intervals to Days 1 and 2 represent a similar division of time, but no sample is pyrolyzed nor is furnace heat introduced during these two pre-test days.

Nine groups of 4 rats each were employed in the behavioral evaluations. The group of trained rats exposed to pyrolysates of the materials, the material used, and the initial sample weight of the material are listed below for each group. The sample weight representing, or approximately one half of the

LD₅₀ for that test sample as indicated by "*".

Group 1 = 10 gm of Y-7683 Group 6 = 5 gm of Y-7684

* Group 2 = 15 gm of Y-7683 Group 7 = 10 gm of Y-7684

Group 3 = 20 gm of Y-7683 * Group 8 = 15 gm of Y-7684

* Group 4 = 10 gm of Y-7685 Group 9 = 20 gm of Y-7684

Group 5 = 15 gm of Y-7685

Results. The performance of each rat on the shock-avoidance schedule for at least 30 minutes preceeding pyrolysis of test sample and for 30 minutes following sample pyrolysis (referred to as Day 3) is shown graphically in Figures 7-42. While the pretest controls (Days 1 and 2) are not presented here, the data were entered in the computer for statistical analysis and comparisons, and mean pre-test responses for the group are contained in summary graphs by groups (Figures 43-51).

Analyses and Discussion. The date were analyzed by Analysis of Variance for Unweighted Means with factors of Groups (9 levels), Days (3 levels), and Times (7 levels). Groups, Days and Times (time intervals) were defined above.

Significant differences were found for all Main and Interaction effects as shown below:

Analysis of Variance Summary Table

Source	Sum of Squares'	DF	<u>Mean Square</u>	F-Ratio	Prob
Group(A) Between Er	138.413 rror 134.307	8 27	17.3017 4.97433	3.478	0.007142
Run (B) AB Within Err	1217.55 309.738 cor 1 120.819	2 16 54	608.776 19.3586 2.23738	272.093 8.652	0.000000 0.000001
Time (C) AC Within Err	589.552 163.106 cor 2 156.445	6 48 162	98.2587 3.39804 0.965710	101.748 3.519	0.000000 0.000001
BC ABC Within Err	1525.06 301.006 cor 3 354.751	12 96 323	127.088 3.13548 1.09830	115.714 2.855	0.00000

Results of Newman-Keul's post hoc test for significance showed no difference between Day 1 and 2 (baseline testing). These baseline measures, averaged across groups are shown in Table 18. Comparisons among animals exposed to pyrolysates of the three samples tested are summarized in Table 19, which presents means and standard deviations for each group on Day 3 (exposure), broken down into pre-burn, burn (pyrolysis), and post-burn blocks.

For purpose of evaluating the behavioral effects of each sample weight, data for each group during each time interval was factored for a comparison over days. Table 20 summarizes the results of post hoc tests for significance of these data.

Data analysis for each of the 9 groups indicated there were no significant differences between any 10 minute time interval on Days 1 and 2 (i.e., pre-test baseline controls), as shown in Table 18. Performance of the rats during the 30 minute pre-burn period (intervals 1, 2 and 3) of the test day (Day 3) did not differ from similar periods of either Days 1 or 2 (baseline controls) as shown in Table 19. Thus it was indicated that the baseline response was suitably stable to proceed with comparisons of materials' pyrolysates up to behavior of the rats.

Summary figures by rat groups (i.e., sample and sample weight) were prepared in which the mean of all rats in this group for the two day baseline responses (Days 1 and 2) are plotted vs. time and on the same figure is the mean response of these animals preceeding, during and after pyrolysis of the sample (Day 3). These are figures 43-51.

Sample Y-7683 The LD₅₀ for this sample was estimated at between 30-40 grams (see Table 4). Since two of the rats exposed to 20 grams for behavioral testing died shortly after testing was completed, tests were repeated with exposures to 15 and 10 grams of the sample.

Group 1 (Sample Y=1683, 10 grams)

Decreased performance was noted for all animals during and after the burn period with only one animal returning to preburn performance level within the last 10 minutes. However, the only statistically significant difference was at the 0.05 level between days two and three during the 6th (10-20 minute postburn) interval. The shock-avoidance behavior for this group, presented as mean values, of Days 1 and 2 (baseline control = triangles) and of pre-burn, burn and post-burn periods (Day 3, experimental = circles) is graphically represented in Figure 43, while the individual rats' performances before, during and after pyrolysis are shown in Figures 7-10.

Observations: Thick yellow smoke prevented observation during the burn period. In the 10 minute post urn period animals remained near the lever and were observed standing on their hind legs with no unusual behavior noted. During the 10-20 minute observation period more activity was noted, with mild loss of coordination in half the animals. Postural slumping was noted in three. During the 20-30 minute observation, coordination worsened for the two noted previously although lever response returned to baseline levels for one of these. During this period all animals spent more time on all four feet than is usual in this situation, with crouching noted for three. Although lever

pressing decreased, all animals continued to flinch and orient toward the lever when shocked.

Group 2 (Sample Y-7683, 15 grams) [approximately & of 14-day LDso]

There was a worsening of performance during the post-burn period. However during the last interval, half of the animals' performance improved markedly. Statistically significant differences at the 0.01 level were noted between days one and three and between days two and three during the 5th (0-10 minute post-burn) interval and at the 0.05 level between days one and three and days two and three during the 6th (10-20 minute postburn) interval.

Observations: Dense smoke with some flame was noted during the burn period. The initial response overall was increased activity with attempts to escape. Some weakness with convulsive breathing was noted. Two of the animals remained ambulatory.

One appeared to be very weak by the end of the burn period, propping himself against the chamber wall to press the lever. These animals responded with movement to all shocks and no loss of coordination was noted. The fourth animal appeared to be stuporous by the 5th interval, responding to shock only occasionally, and ended the session lying on the floor of the chamber motionless. He recovered spontaneously when the chamber was flushed with air.

Responses of individual rats in this group are presented in Figures 11-14. The mean responses for this group are presented in Figure 44.

Group 3 (Sample Y-7683, 20 grams)

Performance deteriorated radically during the postburn period with no lever press response for any animal during the last 10 minutes.

for the 5th, 6th and 7th intervals, there were significant differences at the 0.01 level between days one and three and days two and three.

Observations: Dense smoke (white in 3 observations, black in one) was noted with some flame. After clearing, animal B-1 was observed to lie still with no response for 15 minutes, while the other three engaged in frantic escape attempts. After 15 minutes this animal (B-1) rose, moved around the chamber, and flinched when shocked although he made no attempt to press the He became normally active when the chamber was flushed. B-14 became less active after 10 minutes and by 20 minutes remained prone with labored breathing and no responsiveness to shock. He recovered fully during chamber flushing. B-15 and B-3 made active escape attempts during the first 10 minutes, then became discoordinated and failed to orient toward the lever when shocked. B-15 then lost all responsiveness to shock by 20 minutes and remained lying down with labored breathing while B-3 continued to attempt to rise when shocked but was unable to support his own weight. Both B-3 and B-15 died during flushing of the chamber.

Data from individual rats in this group are shown in Figures 15-18, and group means are shown in Figure 45.

General summary for Sample Y-7683:

For lowest concentrations, loss of coordination with some weakness affected performance, but animals remained responsive to shock and recovery of learned avoidance behavior occurred. At middle concentrations weakness and difficult breathing occurred. Three animals recovered the learned response while one became

stuporous until the chamber was *lushed. At the highest concentration learned response was lost by all subjects. One was initially rendered stuporous but recovered some activity after 15 minutes, while the other 3 went from frantic activity to helplessness. Two of these died as the chamber was flushed.

Group 4 (Sample Y-7685, 10 grams) [tof chamber and 14-day LD 50]

Differences significant at the 0.05 level were found between days one and three and two and three during the 4th (burn) interval and for the 5th, 6th and 7th intervals, these differences were significant at the 0.01 level.

Observations: Thick white smoke was produced in this burning. All animals were ambulatory and oriented toward the lever during the first 10 minute postburn interval. During the 10-20 minute interval (interval #6) some discoordination was noted for three of the animals with some reduced responsiveness to shock. Three of the animals spent much of the time lying down while the fourth lunged at the lever when shocked. This animal regained some coordination while the others became less active as the session progressed. Overall there was never complete loss of responsiveness.

Data from individual rats in this group are shown in Figures 19-22, while group means are shown in Figure 46.

Group 5 (Sample Y-7685, 15 grams)

A difference, significant at the 0.05 level, was found for interval 4 (burn) between days two and three. For the 5th, 6th and 7th interval differences were found between days one and three and days two and three which were significant at the 0.01 level.

Observations: Dense white smoke occurred during the burn,

making observation impossible. At 0-10 minutes postburn all animals spent time walking and rearing toward the lever. General disorientation was apparent. Decreasing coordination and loss of orientation toward the lever was progressive for all. By 15 minutes postburn animals began to spend most of the time lying motionless on their sides and for the last 10 minutes all remained in this position. Recovery occurred rapidly when the chamber was flushed with fresh air.

Behavioral responses of individual rats in this group are shown in Figures 23-26, while group means are presented in Figure 47. General summary for Y-7685:

The pattern of loss of learned response and general impairment was similar at both levels. However at the lower level one animal never became inactive, and some responsiveness to shock remained for all. At the higher level, incapacitation was more rapid and by 20 minutes after pyrolysis of samples all animals appeared insensitive to shock.

<u>Sample Y-7684</u>: Selection of appropriate level of exposure for comparative behavioral effects was very difficult because of (1) the absence of a good LD_{50} value and (2) deaths of rats occurring during the early behavioral tests. It can be noted in the lethality studies of this material that there were no chamber deaths in any group from pyrolysis from 10 to 56.57 grams. Within 48 hours there were several deaths, but these form a pattern of a very flat dose-mortality curve since pyrolysis of 20,30 and 40 grams killed 50% of exposed animals (although other runs with 20 and 40 grams failed to kill any of the animals), and 50 grams killed 100% of

of the animals, but 56.57 grams killed only 50%. The second factor was the unusual finding that a number of rats died during the behavioral test with this sample (20, 15 and 10 gm). Therefore, 4 sample weights (5, 10, 15 and 20 gm) were examined for behavioral effects using this sample.

Group 6 (Sample Y-7684, 5 grams)

No significant differences were found between any intervals on any of the days for Group 6. There was a tendency for mean performance to decrease following the burn period since one animal's performance (B-28)declined rapidly during the last 20 minutes, decreasing from 84% shock-avoidance during the 5 minute postburn interval to 18% by the last 5 minutes. Another animal (B-29) fell from 75% avoidance to 35% during the last 10 minutes.

Behavioral responses of individual rats in this group are shown in Figures 27-30, while group means are presented in Figure 48.

Observations: Some flaming followed by dense white smoke was observed during the burn with visibility in the chamber poor. Throughout the postburn period no unusual behaviors were noted for the two animals (B-27 and B-30) whose avoidance behavior continued at baseline level. B-29 showed little reaction to shock although lever pressing remained steady at about 12% below preburn levels until the last 5 minutes. During this period the animal was observed to spend much of the time walking about the chamber. B-28 appeared unaffected until 10 minutes postburn, when he began to attend more to the chamber walls than the lever. By 20 minutes he showed some loss of coordination, spending more time on all fours away from the lever. However

flinching and orientation toward the lever during shock did not decrease.

Group 7 (Sample Y-7684, 10 grams)

Differences significant at the 0.05 level were found for interval 4 (burn period) between days one and three and days two and three. For the 5th, 6th and 7th (postburn) intervals, differences were found between days one and three and days two and three which were significant at the 0.01 level.

Behavioral responses of individual rats in this group are shown in Figures 31-34, and group means are presented in Figure 49.

Observation: Thick write-grey smoke and some flame was noted. All animals except B-36 were ambulatory during the first postburn interval. These three began to lose coordination after 10 minutes, and decrease general activity. While B-24 leaned against the wall and continued to press the lever occasionally with little other response, B-25 and B-34 slowly lost all responsiveness and lay motionless on the floor for the last 10 minutes. B-36 followed the same pattern but was motionless by 15 minutes postburn. B-25 died before being removed from the chamber.

Group 8 (Sample Y-7684, 15 grams) [approximately $\frac{1}{2}$ of 14-day LD₅₀]

A difference significant at the 0.05 level was found between days one and three and days two and three during the 1st interval. This was in the direction of increased efficiency on the 3rd day. The baseline average of 80% shock avoidance followed the pattern of all other groups. Significant differences at the 0.05 level were found between days one and three and days two and three

for intervals 5, 6 and 7. These were in the direction of decreased avoidance on the third day (i.e., after pyrolysis of sample).

Observations: Two animals (B-21 and B-26) who appeared to be unconscious by the last 5 minutes of the postburn period were found to be dead when removed from the chamber. These animals were both responsive during the first 10 minutes postburn but soon lost all responsiveness and lay in the chamber having diff-culty breathing. Both animals that lived lost some coordination after the first 10 minutes. One gradually lost the avoidance response and was lying on the chamber floor by 25 minutes although he continued to flinch to shock. The other lost coordination and remained in a slumping posture. However, he continued to lunge at the lever and although his manner of response was not normal he maintained effective avoidance.

Behavioral responses of individual rats in this group are shown in Figures 35-38, while group means are presented in Figure 50.

Group 9 (Sample Y-7684, 20 grams)

For interval 4, the burn interval, and interval 5, there was a statistically significant difference between days two and three and days one and three at the 0.05 level. For intervals 6 and 7 the same differences occurred at the 0.05 level.

Observations: Three of these animals died, two in the chamber during the last interval and one upon removal. Serious impairment became obvious after 10 minutes with loss of

coordination, slumping and finally loss of all responsiveness.

The animal that survived demonstrated almost the same pattern, with short bursts of recovery and lunging at the lever.

Behavioral responses to individual rats in this group are shown in Figures 39-42, while group means are presented in Figure 51.

General summary for Sample Y-7684

Increasing impairment in a dose-related fashion was seen, with 5 grams appearing to be somewhat effective (but not statistically significant), 10 grams highly significant, and 15 and 20 grams producing lethalities with behavioral impairment in the survivors.

Physical parameters.

The physical parameters involved in each of the behavioral tests are tabulated in Table 21. These are presented by rat groups and include identification of the animal and its weight, range of chamber temperatures during pyrolysis and exposure, the temperature to which the furnace was pre-heated prior to introducing the sample, the minimum furnace temperature after introducing the sample, the final furnace temperature at the end of pyrolysis (on removal), and the weight of residue.

RELATIVE TOXICITY OF SAMPLES

The relative toxicity of these samples was quite similar by the *in-chamber pyrolysis* method at the end of the 14-day post-exposure observation period, with overlapping 95% confidence intervals. On the other hand, Vonar 3 on N W Polyester (Y-7685) produced all deaths in the exposure chamber, while Vonar 3 on Fiberglass (Y-7684) produced its lethalities after removal from the chamber but within 48 hours, and LS 200 (Y-7683) exposure resulted in most deaths between 48 hours and 14-days. (The actual LD_{50} s for Y-7683 and Y-7684 must be considered as approximations.)

The relative toxicities of these samples were not greatly different from each other by the MSTL procedure, but the 95% confidence intervals were not overlapping. While differences were not great between samples, they can be ranked in order of decreasing toxicity as: Y-7684 (Vonar 3 on Fiberglass), Y-7685 (Vonar 3 on N W Polyester), and Y-7683 (LS 200). The relative ranking is the same whether one considers initial sample weight for the LD $_{50}$ or whether one considers the actual quantity of sample pyrolyzed.

Ranking these samples according to <u>decreasing</u> detrimental effect upon conditioned-avoidance performance when exposed to one-half of the LD $_{50}$ would be as follows: Y-7684 (Vonar 3 on Fiberglass), Y-7685 (Vonar 3 on N W Polyester), and Y-7683 (LS 200). Because of the problems in determining the LD $_{50}$ values for two of these samples, and the large 95% confidence intervals, it is possible the relative toxicities may change with a more precise lethality exposure-response curve. Ranking of Y-7684 as most detrimental to the rats' behavioral performance was based partially upon death of some rats during or immediately after the test.

Table 1

IDENTIFICATION OF TEST SAMPLES

Code Number	Description of Test Sample	Maximum Temp. for Thermodegradation*	Residue*	Amount Pyrolyzed*
Y-7683	LS 200 (a neoprene plastic foam) A pink colored, spongy material such as might be used for seat cushions.	. 200°C.	44%	56 %
Y-7684	Vonar 3 on Fiberglass A light, almost white spongy material (approx. 3/16") on a woven fiberglass backing.	. 2°0°3	478	53.88
Y-7685	Vonar 3 on N W Polyester A light, almost white spongy material (approx. 1/4") on a polyester backing.	. 295° C.	32g	68 8
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			

These are obtained from TGA pyrolysis in air. They are employed as approximations for the purpose of determining the relative completeness of pyrolysis during the LDso and behavioral studies. However, because the LDso and behavioral studies utilize much larger quantities of samples, heat distribution within the sample may be less uniform and the atmosphere immediate to the sample may be less oxidative thereby resulting in a *These are obtained from TGA pyrolysis in air. larger residue than this idealistic value.

Table 2

Analysis of TGA Data

		•	•	
Sample No.	Y-7683	Y-7683	Y-7684	Y-7684
Identification	LS 200	LS 200	Vonar 3 on Fiberglass	Vonar 3 on Fiberglass
TGA Run No.	382	389	385-	386
Atmosphere	Air	Nitrogen	Air	Nitrogen
Flow Rate	20 ml/min	20 ml/min	20 ml/min	20 m]/min
Heating Rate	20°C/min	20°C/min	20°C/min	20°C/min
Sample Weight	13.60 mg	13.36 mg	8.08 mg	9.06 mg
Initiation of Decomposition *	220°C	200°C	220°C	230°C
Completion of Decomposition *	3.099	230°C	J°063	575°C
Maximum TGA Temp.	870°C	961°C	920℃	955°C
Final Residue Wt.	60.4 mg	5.80 mg	3.76 mg	4.74 mg
Percent Final Residue	44%	43%	47°	52%
Temperature for 50% Degradation	200c	490°C	525°C	Not attained
Percent Residue at 600°C	44%	45%	482	56 8

* Approximate Values

Table 2

Analysis of TGA Data

		•	
Sample No.	Y-7685	Y-7685	
Identification	Vonar 3 on N W Polyester	Vonar 3 on N W Polyester	
TGA Run No.	394	392	
Atmosphere	Air	Nitrogen	
Flow Rate	20 ml/min	20 ml/min	
Heating Rate	20°C/min	20°C/min	
Sample Weight	71.18 mg	10.06 mg	
Initiation of Decomposition *	220°C	250°C	
Completion of Decomposition *	595°C	2.009	
Maximum TGA Temp.	3°826	974°C	
Final Residue Wt.	3.56 mg	3.28 mg	
Percent Final Residue	32%	33%	
Temperature for 50% Degradation	475°C	465°C	
Percent Residue at 600°C	33%	34%	

* Approximate Values

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Upon	,
Based	lyzed
5.0	Initial Weight of Sample Pyrol
Θ,	

Table 3

to Shift .

14 Days	28 gm ** (20-40)	28 gm ** (16-50)	19.95 gm (14.56-27.35)		3.46 gm (3.36-3.56)	2.69 gm (2.58-2.80)	3.09 gm (2.89-3.31)
48 Hours	> 50 gm ()	28 gm ** (16-50)	19.95 gm (14.56-27.35)		3.46 gm (3.36-3.56)	2.69 gm (2.58-2.80)	3.09 gm (2.89-3.31)
Chamber Deaths	> 50 gm ()	> 56 gm	19.95 gm (14.56-27.35)		3.46 gm (3.36-3.56)	2.69 gm. (2.58-2.80)	3.09 gm (2.89-3.31)
Chamber Death In-Chamber Pyrolysis Procedure*	LS 200 (Foam)	Vonar 3 on Fiberglass	Vonar 3 on N W Polyester	MSTL Procedure***	LS 200 (Foam)	Vonar 3 on Fiberglass	Vonar 3 on N W Polyester
Sample	Y-7683	Y-7684	Y-7685	MS	Y-7683	Y-7684	Y-7685

* Chamber volume is approximately 200 liters (198 L).

These values should be considered as approximations $\,$ since data on delayed deaths was not sufficient to obtain good estimates of the delayed LD $_{5\,0}$. *

^{***} Chamber volume is approximately 64 liters.

Table 4
SUMMARY
Cumulative Mortality

In-Chamber Pyrolysis

<u>Sample</u>	Sample Wt. (gm	<u> %Pyrolyzed</u>	<u>Cumulat</u> <u>Chamber</u>	ive Morta 48 hr	<u>lities</u> 14 day
Y-7683	5* 10* 15 20* 25 30 40* 50	60% 54% 54% 50% 54% 47% 47% X*=52% X*=53%	0/4 0/4 2/4 0/4 0/4 0/4 0/4	0/4 0/4 2/4 0/4 0/4 0/4 1/4	0/4 0/4 2/4 0/4 1/4 1/4 4/4
Y-7684	10* 10 20* 20 30 40* 40 50 56.57	52% 53% 54% 50% 44% 46% 47% 43% 45% = 48% X*=51%	0/4 0/4 0/4 0/4 0/4 0/4 0/4	0/4 0/4 2/4 0/4 2/4 2/4 0/4 4/4 2/4	0/4 0/4 2/4 0/4 2/4 0/4 4/4 2/4
Y-7685	10* 14.14* 20* 28.28* 40*	67% 63% 69% 58% 62% ** = 64%	0/4 1/4 2/4 3/4 4/4	0/4 1/4 2/4 3/4 4/4	0/4 1/4 2/4 3/4 4/4

 $^{^*}$ Indicates data used in LD50 Calculations.

Table 5
Summary
MSTL Pyrolysis
Procedure

<u>Sample</u>	Sample Wt. (gm.	.) %Pyrolyzed	<u>Cumulat</u> <u>Chamber</u>	ive Morta 48 hr	lities 14 day
Y-7683	3.12* 3.31* 3.51* 3.72* 3.94* 4.96 6.25 12.50 50.00	55% 56% 54% 56% 58% 58% 55% = 55% X	0/4 0/4 3/4 4/4 4/4 3/4 4/4	0/4 0/4 3/4 4/4 4/4 4/4 3/4 4/4	0/4 0/4 3/4 4/4 4/4 4/4 4/4 4/4
Y-7684	2.45* 2.60* 2.76* 2.93* 2.93 3.11* 3.30 3.50	53% 57% 58% 60% 53% 51% 56% 53% = 55% X*	0/4 1/4 3/4 4/4 1/4 4/4 4/4	0/4 1/4 3/4 4/4 1/4 4/4 4/4	0/4 1/4 3/4 4/4 1/4 4/4 4/4
Y-7685	2.00 2.52* 2.68* 2.84* 3.01* 3.19* 3.38* 3.58* 4.03	75% 68% 68% 69% 66% 70% 68% 66% = 68% X * = 68%	0/4 0/4 1/4 1/4 2/4 1/4 3/4 4/4	0/4 0/4 1/4 1/4 2/4 1/4 3/4 4/4	0/4 0/4 1/4 1/4 2/4 1/4 3/4 4/4

 $^{^{\}star}Indicates$ Data used in LD $_{5\,0}$ Calculations.

Table 6

14 Day LDso Values: Extrapolations and Standardized Comparisons

sate*	74.9 kg	29.7 kg	72.1 kg	23.5 × 5 × 6	64.6 kg	32.8 8.7 8.0
Pyrol	74	S) D)	72	23	9	32
LDso of Pyrolsate* per Liter per M ³	75 ng	30 08	72 mg	24 mg	65 E	33 E E E
LOso of Pyrolysate	14.8 90	1.90 gm	14.3 90	rv E	12.8 gm	2.10 gm
Pyrolysate	53 53 54	က သ	10 20	566	644 84	68 <i>%</i>
Procedure* Pyrolysate	In-Chamber	ISE	In-Chamber	I S	In-Chamber	- S
1000	28 gm	3.46 gm	28 gm	2.69 gm	20 mg	3.09 gm
-	LS 200 (Foam)	LS 200 (Foam)	Vonar 3 on Fiberglass	Vonar 3 on Fiberglass	Vonar 3 on N W Polyester	Vonar 3 on N W Polyester
Sample	Y-7683	Y-7683	Y-7684	Y-7684	Y-7685	Y-7685

*Ihis is not a direct measure of weight of pyrolysate, but rather represents the weight loss of the original sample during pyrolysis.

**Volume of chamber used for "in-chamber" pyrolysis was 198 liters (~6.2 M^2); volume of chamber used for the MSTL procedure was 64 liters (0.064 M^3).

Table 7

SUMMARY: In-Chamber Pyrolysis/Combustion Studies

Y-7683 (LS 200 Foam)

,	l 1	1	1	ŀ	1	1	ţ	1	i		1	ગદુ≎. !!	.ge⇒0 H
20 gm*	26	0/4, 0/4, 0/4	50	n/a	15.1/13.9/13.8	0.17/0.22/0.38	0.19/0.17/0.14	0.2%	0.1%	[/Bm 9	10 pp:	>20 ppm	
15 gm	25	2/4, 2/4, 2/4	54	54%	18.0/18.0/16.9	0.87/0.95/1.18	0.32/0.30/0.27	0.8%	0.4%	1/bm 6	30 ppm	3 ppm	1
10 gm*	24	0/4, 0/4, 0/4	54	n/a	16.5/16.4/13.8	0.45/0.45/0.50	0.18/0.19/0.13	0.3%	0.2%	1/gm 6	30 ррт	2 ppm	
5 gm	23	0/4, 0/4, 0/4	09	n/a	17.5/15.9/15.8	0.18/0.34/0.46	0.18/0.18/0.16	0.1%	0.1%	10 mg/1	7 ppm	mdd L	1
Sample Wt.	Group	Cumulative Mortalityb	% Pyrolyzed	× COHPC	0 ₂ (GC) ^d	co ² (ec) ^d	p(29) 02	e co2	e 00	Н20е	HCNe	нге	нсте

Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed. ڡ

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis and data indicate percent by weight at these times. o o

Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. Used in LDso calculation. a) *

Table 7 (cont.)

SUMMARY: In-Chamber Pyrolysis/Combustion Studies

Y-7683 (LS 260 Foam)

Sample Wt.	25 gm	30 dm	40 qm*	20 gm
Group			29	
Cumulative Mortality ^b	0/4, 0/4, 1/4	0/4, 0/4, 1/4	0/4, 0/4, 4/4	0/4, 1/4, 4/4
% Pyrolyzed	54	49	47	47
× сонь	n/a	n/a	n/a	n/a
p(20) Z0	20.5/19.8/19.8	18.5/17.2/18.0	19.8/19.8/18.9	18.5/18.5/19.5
co ² (ec) ^d	0.58/0.70/0.94	0.76/0.81/0.96	0.75/0.90/1.11	0.22/0.40/0.49
p(29) 02	0.14/0.14/0.12	0.21/0.20/0.20	0.15/0.15,0.13	0.07/0.07/0.06
co ₂ e	0.4%	0.2%	0.4%	0.2%
e 00	0.2%	0.1%	0.1%	0.1%
н ₂ 0е	1/6m &	10 mg/1	5 mg/l	1/gm 11
HCNe	30 ppm	50 ppm	ng ppm	25 ppm
H e H H	>20 ppm	>20 ppm	>20 ppm	>20 ppm
HC1e	1 1. 1			
a Number	in parentheses indicates	ates percent degradation by weight.	ion by weight.	

Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed. مہ ہ

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis and data indicate percent by weight at these times. Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. ပ ဗ

Used in LDso calculation. a) *

Table 7 SUMMARY: In-Chamber Pyrolysis/Combustion Studies Sample Y-7684 (Vonar 3 on Fiberglass)

	ı	l	Į	. 1		4	·5	1	<u> </u>	1	Ur I I			••• 	l
	20 gm	47	0/4, 0/4, 0/4	50	n/a	19.2/20.0/19.0	0.54/0.72/0.79	0.18/0.19/0.18	0.4%	0.1%	7 mg/1	40 ppm	>20 ppm	>20 ppm	
	20 gm*	44	0/4, 2/4, 2/4	54	n/a	21.0/20.9/20.9	1.05/1.19/1.32	0.28/0.27/0.27	0.2%	91.0	2 mg/1	25 ppm	15 ppm	12 ppm	ion by weight.
	10 gm	46	0/4, 0/4, 6/4	53	n/a	22.7/23.4/22.5	0.52/0.74/0.84	0.13/0.13/0.12	0.4%	0.1%	1/Bm 01	25 ppm	>20 ppm	ndd Ol	indicates percent degradation by weight
	10 gm*	31	0/4, 0/4, 0/4	52	n/a	20.4/22.7/21.4	0.78/1,05/0.96	9.19/0.21/0.14	%9.0	0.2%	1 1 1	35 ppm	>10 ppm	} 	in parentheses
-	Sample Wt.	Group	Cumulative Mortality ^b	% Pyrolyzed	× cohp ^c	0 ₂ (GC) ^d	co ² (ec) ^d	p(၁၅) 0၁	c0 ₂ e	a 00	Н20е	HCNe	НЕ	HC1e	a Number

namber in parentheses indicates percent degradation by weight. Mortality expressed as number of animals dying in chamber, within 48 hours, and within a v

14 days per number of animals exposed.

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis and data indicate percent by weight at these times. συ

Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. Used in LDso calculation. **u** *

Cl₂ trace at 10 gm, - (0.3 ppm) at 20 and 40 gm. NO²trace at 10 gm, - (2 ppm) at 20 and 40 gm. Note: Measurements of Cl2 & Nitrogen Oxides

SUMMARY: In-Chamber Pyrolysis/Combustion Studies Sample Y-7684 (Vonar 3 on Fiberglass) Table 7 (Continued)

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	ı	1		1	1	4	⊦6 !	ļ	l	UF 	1 	ンベ () 	!UAL		ļ
b man	50 gm	38	0/4, 4/4, 4/4	43	n/a	20.0/21.2/21.7	0.41/0.63/0.86	0.12/0.12/0.14	0.2%	0.1%	4 mg/ī	20 ppm	>20 ppm	20 ррш	
	40 gm	48	0/4, 0/4, 0/4	47	n/a	20.3/20.1/19.1	0.42/0.53/0.67	0.10/0.10/0.10	0.2%	0.1%	8 mg/l	45 ppm	>20 ppm	>20 ppm	ion by weight.
	40 gm*	32	0/4, 2/4, 2/4	46	n/a	20.0/18.3/19.0	0.34/0.40/0.52	0.08/0.06/0.05	0.3%	0.1%	10 mg/l	09 mdd	з ррт	150 ррш	ates percent degradation by weight.
	30 gm	45	0/4, 2/4, 2/4	44	n/a	21.8/21.8/20.4	0.79/1.02/0.98	0.20/0.20/0.17	0.4%	0.1%	10 mg/1	25 ррт	>20 ppm	10 ppm	in parentheses indicates
	Sample Wt.	Group	Cumulative Mortalityb	% Pyrolyzed	× cohb ^c	05 (GC) ^d	co ⁵ (ec) _q) _p (၁၅) 0၁	e ² 00	a 00	Н ₂ 0е	HCNe	НЕе	нсле	a Number

Mortality expressed as number of animals dying in chamber, within 48 hours, and within <u>۔</u>

14 days per number of animals exposed.

c Carboxyhemoglobin analyses were performed only on animals dying in the chamber. d GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis and data indicate percent by weight at these times. e Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan.

Used in LDso calculation. **a** *

Cl₂ trace at 10 gm, - (0.3 ppm) at 20 and 40 gm. NO trace at 10 gm, - (2 ppm) at 20 and 40 gm Note: Measurements of CL2 and Nitrogen Oxides

SUMMARY: In-Chamber Pyrolysis/Combustion Studies Sample Y-7684 (Vonar 3 on Fiberglass) Table 7 (Continued)

**************************************										•			
Management													
56.57 gm	49	0/4, 2/4, 2/4	45	n/a	20.9/18.5/18.5	0.40/0.54/0.62	0.04/0.04/0.04	0.2%	<0.1%	8 mg/l	>60 ppm	>20 ppm	>20 ppm
Sample Wt.	Group	Cumulative Mortalityb	% Pyrolyzed	× cohp ^c	02 (GC) ^d	p(09) ⁷ 00	_p (၁၅) 0၁	c0 ² e	e 00	н ₂ 0е	HCNe	. НЕ	нсте

Mortality expressed as number of animals dying in chamber, within 48 hours, and within

14 days per number of animals exposed. ڡ

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis

and data indicate percent by weight at these times. Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. g O

e measurements of Cl₂ and Nitrogen Oxides Cl₂ trace at 10 gm, - (0.3 ppm) at 20 and 40 gm. Note: Measurements of Cl₂ and Nitrogen Oxides NO trace at 10 gm, - (2 ppm) at 20 and 40 gm.

Original pace is

	ı		<u> </u>	•	1 1	4 	-8 		OF	POO	R QL	JALI"	YY.	I	ı
	28.28 [*] gm	37	3/4, 3/4, 3/4	58	64%	18.5/19.8/20.3	1.04/1.26/1.55	0.26/0.26/0.28	0.4%	0.2%	1/6m 01	40 ppm	>20 ppm	>20 ppm	
	20 [*] gm	34	2/4, 2/4, 2/4	69	71%	18.9/19.4/19.4	2.01/2.19/2.27	0.31/0.31/0.30	1.0%	0.1%	11 mg/1	50 ppm	4 ppm	63 ppm	ion by weight.
	14.14 [*] gm	35	1/4, 1/4, 1/4	63	76%	16.0/16.8/	1.62/1.81/	0.25/0.26/*****	0.8%	0.1%	8 mg/1	50 ppm	2 ppm	38 ppm	ates percent degradation
-	lo*gm	36	0/4, 0/4, 0/4	67	n/a	17.4/16.0/16.6	1.34/1.36/1.52	0.22/0.20/0.20	%9.0	0.1%	8 mg/1	30 mdd	l ppm	25 p.pm	in parentheses indicates
-	Sample Wt.	Group	Cumulative Mortalityb	% Pyrolyzed	× coHp ^c	02 (GC) ^d	(05) ⁷ 00	p(၁၅) 0၁	c0 ² e	_a 00	н ² 0е	нсме	НГе	HC1e	a Number

Mortality expressed as number of animals dying in chamber, within 48 hours, and within Ω

14 days per number of animals exposed.

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis and data indicate percent by weight at these times. Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. O TO

 \star Used in LDs, calculation Note: Detector tubes for Cl $_2$ (-00.33 ppm) and NO $_{\rm X}$ (-02ppm) were used on 20 and 40 gm runs o *

SUMMARY: In-Chamber Pyrolysis/Combustion Studies Sample Y-7685 (Vonar 3 on N W Polyester) (Continued) Table 7

STATISTICS.

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or Por	OUS OF	PALITY				4	9							
	40 *m	33	4/4, 4/4, 4/4	62	%89	17.2/16.7/18.1	1.47/1.41/1.18	0.46/9.35/0.31	1.0%	0.3%	23 mg/T	mdd 09<	>20 ppm	- CO E
	Sample Wt.	Group	Cumulative Mortalityb	% Pyrolyzed	× cohp ^c	02 (GC) ^d	co ² (ec) _q	p(09) 00	e ² 00	a 00	Н ₂ 0е	HCNe	НЕе	HC1e

Mortality expressed as number of animals dying in chamber, within 48 hours, and within in parentheses indicates percent degradation by weight.

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis 14 days per number of animals exposed. UP

Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. and data indicate percent by weight at these times. * Used in LDso calculation.

%ote: Detector tubes for ${
m Cl}_2$ (-00.33 ppm) and ${
m NO}_{
m X}$ (-02 ppm) were used on 40 and 60 gm runs

SUMMARY: MSTL Pyrolysis/Combustion Studies Sample Y-7683 (LS 200 Foam) Table 8

					50		0.1		O :	nen Nen		Maria Maria Maria		
3.72 gm*	9	4/4, 4/4, 4/4	56	728	16.1/16.3/15.7/16.1/17.0	2.37/2.39/1.96/1.66/1.40	0.26/0.38/0.31/0.26/0.22	1.0%	<0.05%	4 mg/1	spm	-0 0.5 թրո	nt	4
3.51 gm*	58	3/4, 3/4, 3/4	54	%09	16.6/15.9/16.4/17.6/17.3	1.65/1.23/1.05/0.95/0.77	22/0.17/0.10/0.08/0.05 0.24/0.17/0.14/0.12/0.09	2.2%	0.1%	12 mg/ì	2.5 ppm	-@ 0.5 ppm	ļu	ion by weight.
3.31 gm*	59	0/4, 0/4, 0/4	56	n/a	16.8/17.3/17.5/17.5/17.5	2.12/1.89/1.68/1.59/1.49		1.2%	0.2%	8 mg/1	5 ppm	nt	nt	ates percent degradation by
3.12 gm*	42	0/4, 0/4, 0/4	55	n/a	19.1/18.0/20.4/19.7/21.1 16.8/17.3/17.5/17.5/17.5 16.6/15.9/16.4/17.6/17.3 16.1/16.3/15.7/16.1/17.0	1.63/1.40/1.50/1.36/1.42 2.12/1.89/1.68/1.59/1.49 1.65/1.23/1.05/0.95/0.77 2.37/2.39/1.96/1.66/1.40	0.27/0.17/0.13/0.09/0.06	0.25%	200 ppm	4 mg/1	2 ppm	0.5 ppm	nt	in parentheses indicates
Sample Wt.	Group	Cumulative Mortality ^b	% Pyrolyzed	× cohp _c	02 (GC) ^d	co ⁵ (ec) _q		c0 ² e	e 00	Н20е	HCNe	нге	нсте	a Number

Mortality expressed as number of animals dying in chamber, within 48 hours, and within م ہ

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken at 0, 15, 30, 45 and 60 minutes after pyrolysis/combustion and data indicate percent by weight at these times. Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. 4 days per number of animals exposed. O TO

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Used in LDso calculation. Not tested. n * n

MSTL Pyrolysis/Combustion Studies Sample Y-7683 (LS 200 Foam) Table 8 (Continued)

SUMMARY:

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Sample Wt.	3.94 gm*	4.96 gm	6.25 gm	12.5 gm
Group	57	43	41	40
Cumulative Mortality ^b	4/4, 4/4, 4/4	4/4, 4/4, 4/4	3/4, 3/4, 3/4	4/4, 4/4, 4/4
% Pyrolyzed	54	58	55	58
× cohp ^c	80%	72%	78%	80%
02 (GC) ^d	18.0/18.3/1	9.0 21.2/23.8/23.6/23.1/24.6 19.0/21.3/22.3/20.4/21.3 14.4/16.3/16.3/19.2/19.9	19.0/21.3/22.3/20.4/21.3	14.4/16.3/16.3/19.2/19.9
co ₂ (cc) ^d	2.48/1.82/1.31/1.07/0.76	2.48/1.82/1.31/1.07/0.76 2.58/2.10/1.49/0.96/0.88 2.34/1.94/1.44/0.94/0.78 3.92/3.51/2.09/1.78/1.20	2.34/1.94/1.44/0.94/0.78	3.92/3.51/2.09/1.78/1.20
p(29) 02	0.42/0.31/0.22/0.18/0.12	0.42/0.31/0.22/0.18/0.12 0.67/0.50/0.37/0.26/0.21 0.44/0.34/0.24/0.20/0.11 1.11/0.99/0.62/0.53/0.37	0.44/0.34/0.24/0.20/0.11	1.11/0.99/0.62/0.53/0.37
C0 ₂ e	1.5%	0.2%	0.2%	0.5%
a 00	0.1%	e00 ppm	0.1%	0.18
Н ₂ 0е	14 mg/1	4 mg/l	3 mg/1	4 mg/1
HCNe	2 ppm	2 ppm	2 ppm	4 ppm
HFe	2.5 ppm	0.2 ppm	ndq l	I ppm
нсте	-@2 ppm	1u	-@1 ppm	2 ppm
N	in a second because indicator	stor nowront donradation hy weight	ion hy weight	

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Number in parentheses indicates percent degradation by weight. Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed.

GC samples were taken at 0, 15, 30, 45 and 60 minutes after combustion/pyrolysis and data indicate percent by weight at these times. Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. Carboxyhemoglobin analyses were performed only on animale dying in the chamber. ပ ဗ

Used in LD_{50} calculation. Not tested.

MSTL Pyrolysis/Combustior Stidies Sample Y-7683 (LS 200 Foant Table 8 (Continued) SUMMARY:

	ο φ	RIGIN/ F POG	AL PACI OR QUA	eis Lity		5	52		! 	ļ	ļ		ł	i	l
		Annual Property of the Control of th													
															by weight
	,														degradation b
															i
															ates percent
			4			4.9/17.2	.26/3.47	.81/1.26							s indica
	50 gm	39	4/4, 4/4, 4/4	52	29%	12.8/12.1/13.2/14.9/17.2	5.26/5.68/5.51/5.26/3.47	1.19/1.90/1.93/1.81/1.26	0.5%	0.1%	4 mg/1	20 ppm	7 ppm	8 ppm	in parentheses indic
=				P		12.8	5.26	1.19							
•	Sample Wt.	Group	Cumulative Mortalityb	% Pyrolyzed	× cohb ^c	0 ₂ (6c) ^d	co ² (ec) ^d	p(29) 02	co ₂ e	e 00	н ² 0е	HCNe	НЕ	HCle	a Number

Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed.

Carboxyhemoglobin analyses were performed only on animals dying in the chamber. GC samples were taken at 0, 15, 30, 45 and 60 minutes after pyrolysis/combustion and data indicate percent by weight at these times. Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. g G

Used in LDso calculation.

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•	general transition of the contract of the cont	-	account of the control of the contro	
Sample Wt.	2.45 gm*	2.60 gm*	2.76 gm*	2.93 gm*
Group	67	99	65	89
Cumulative Mortality ^b	0/4, 0/4, 0/4	1/4, 1/4, 1/4	3/4, 3/4, 3/4	4/4, 4/4, 4/4
% Pyrolyzed	53	57	58	09
x cohp _c	n/a	nt	57%	498
02 (GC) ^d	19.9/16.9/15.7/19.3/21.7	19.9/16.9/15.7/19.3/21.7 14.4/16.4/15.4/16.2 15.5/15.2/18.5/20.6/18.2 15.2/18.0/16.0/19.1/17.7	15.5/15.2/18.5/20.6/18.2	15.2/18.0/16.6/19.1/17.
co ² (ec) _q	2.10/1.55/1.38/1.53/1.65	2.10/1.55/1.38/1.53/1.65 1.48/1.38/1.18/1.16/1.06 1.41/1.13/0.93/0.83/0.56 1.42/1.34/0.74/0.55/0.30	1.41/1.13/0.93/0.83/0.56	1.42/1.34/0.74/0.55/0.3
p(၁၅) 00	0.20/0.12/0.07/0.06/0.05	.05 0.14/0.10/0.05/0.04/0.02 0.15/0.10/0.07/0.05/0.02 0.14/0.12/0.04/0.02/0.01	0.15/0.10/0.07/0.05/0.02	0.14/0.12/0.04/0.02/0.0
co ₂ e	0.6%	9.0%	0.5%	0.4%
_e 00	0.1%	0.1%	5.1.9	0.13
Н ₂ 0е	L/Bm 6	12 mg/1	13 mg/1	16 mg/1
HCNe	nt	nt	nt	nt
нге	2 ppm	2 ррт	2 ррш	2 ppm
нсте	nt	ء د	nt	nt
a Number	r in parentheses indicates	ates percent degradation by weight.	ion by weight.	

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number in parentneses indicates percent degradation by weight. Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed.

Carboxyhemoglobin analyses were farformed only on animals dying in the chamber. GC samples were taken at 0, 15, 30, 45 and 60 minutes after combustion/pyrolysis and data indicate percent by weight at these times. U TO

Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. e Measurements mare * Used in LDso calculation.

Not tested.

SUMMARY: MSTL Pyrolysis/Combustion Studies Sample Y-7684 (Yonar 3 on Fiberglass) Table 8 (Continued)

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	and the same of th			OF
Sample Wt.	2.93 gm	3.11 gm*	3.30 gm	3.50 gm 3.50
Group	63 ^f	64	62	NAL PI BOR QI
Cumulative Mortality ^b	1/4, 1/4, 1/4	4/4, 4/4, 4/4	4/4, 4/4, 4/4	GEIT 4/4 , 4/4 , 4/4
% Pyrolyzed	53.9	n I	56	53 h
<u>х</u> сонь ^с	20%	70%	645	59%
02 (GC) ^d	15.4/15.4/15.4/17.6/16.3	15.8/15.2/16.8/16.2/19.0	18.4/16.0/16.9/17.7/18.4	15.8/15.2/16.8/16.2/19.0 18.4/16.0/16.9/17.7/18.4 19.0/16.6/20.3/17.3/23.0 @
co ² (ec) _q	1.41/1.22/1.07/0.98/0.78	1.82/1.34/1.04/0.68/0.51	1.76/1.07/0.73/0.52/0.34	2.16/1.52/1.37/0.85/0.85
_p (၁၅) ၀၁	0.19/0.13/0.09/0.07/0.04	0.25/0.17/0.12/0.07/0.06	0.25/0.17/0.12/0.07/0.06 0.23/0.13/0.08/0.05/0.01	
co ⁵ e	0.5%	0.6%		
_a 00	21.0	0.1%	0.18	0.18
H ₂ 0e	1/6m 9	8 mg/1	14 mg/1	7 ng/1
HCNe	nt	nt	nt	- @ 2.5 ppm
НFе	3 ррт	2.5 ppm	7 ppm	0.2 ppm
HC1e	nt	nt	'n	- @ 25 ppm
a Number	in parentheses indicates	ites percent degradation	ion by weight.	

Mortality expressed as number of animals dying in chamber, within 48 hours, and within Carhovuhomonlokin animals exposed. م. ه

Carboxyhemoglobin analyses were performed only on animals dving in the chamber. 6C samples were taken at 0, 15, 30, 45 and 60 minutes after pyrolysis/combustion and data indicate percent by weight at these times. 4- له o o

Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. Group 63 replaced by Group 68 10sed in LDss calculation NO tubes - @ 2 ppm h NO tube = 2 ppm and Cl2 -@ 0.33 ppm

Not tested.

Sample Wt.	2.00 gm	2.52 gm*	2.68 gm*	2.84 gm*
Group	69	70	77	76
Cumulative Mortalityb	0/4, 0/4, 0/4	0/4, 0/4, 0/4	1/4, 1/4, 1/4	1/4, 1/4, 1/4
% Pyrolyzed	75	68	89	69
× COHPC	n/a	n/a	64%	59%
02 (GC) ^d	22.1/16.7/17.2/18.0/17.8	20.3/16.0/22.7/16.8/17.3	20.3/16.0/22.7/16.8/17.3 18.9/19.7/20.8/16.1/16.9	18.0/17.7/21.5/17.5/16.1
co ₂ (cc) ^d	2.08/1.41/1.31/1.31/1.27	2.19/1.82/2.19/1.67/1.62	2.19/1.82/2.19/1.67/1.62 1.65/1.43/1.32/0.90/0.80 1.76/1.48/1.45/1.06/0.93	1.76/1.48/1.45/1.06/0.93
p(25) 00	0.24/0.12/0.11/0.06/0.04	0.31/0.26/0.27/0.15/0.12	0.24/0.12/0.11/0.06/0.04 0.31/0.26/0.27/0.15/0.12 0.25/0.18/0.11/0.05/0.02 0.29/0.21/0.16/0.09/0.06	0.29/0.21/0.16/0.09/0.06
co ₂ e	0.3%	nt	nt	nt
a 00	0.1%	nt	500 ppm	100 ppm
Н20е	4 mg/1	nt	nt	nt
HCNe	mdd 5	nt	mdd þ	-02.5 ppm
нғе	2 ppm	nt	ļu	nt
нсле	-02.5 ppm	nt	nt	nt
a Number in b Mortality 14 days pe	parentheses in expressed as new number of an	dicates percent degradat umber of animals dying i imals exposed	dicates percent degradation by weight. umber of animals dying in chamber, within 48 hours, an imals exposed.	hours, and within

55

c Carboxyhemoglobin analyses were performed only on animals dying in the chamber. d GC samples were taken at 0, 15, 30, 45 and 60 minutes after pyrolysis/combustion and data indicate percent by weight at these times. e Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. * Used in LDso calculation.

SUMMARY: MSTL Pyrolysis/Combustion Studies Sample Y-7685 (Vonar 3 on N & Polyester) Table 8 (Continued)

ORIGIN OF PO		AGE IS				56		Q)						
.,,	3.58 ga*f	73	4/4, 4/4, 4/4	68	63%	16.0/16.0/15.8/20.2/17.0	2.08/2.20/1.82/1.79/1.19	0.33/0.43/0.35/0.34/0.22	nt	50 ppm	2 mg/1	nt	nt	nt
	3.38 gm*	74	3/4, 3/4, 3/4	69	66%	16.7/17.9/18.5/18.2/20.2	1.87/1.57/1.06/0.90/0.85	0.32/0.24/0.12/0.10/ 9	nt	800 ppm	nt	-02.5 ppm	udd. L	nt
	3.19 gm*	71	1/4, 1/4, 1/4	70	62%	16.8/17.1/17.9/21.3/18.5	2.38/2.06/1.99/2.06/1.72	0.35/0.27/0.22/0,19/0.13	nt	0.1%	4 mg/1	2 ppm	T ppm	-02.5 ppm Cl ₂ -00.03 ppm
	3.01 gm*	75	2/4, 2/4, 2/4	99	%09	15.6/15.6/16.9/19.1/19.1	1.71/1.52/1.22/1.17/1.06	0.27/0.19/0.14/0.12/0.08	nt	800 ppm	nt	4 ppm	mdd L	nt
	Sample Wt.	Group	Cumulative Mortality ^b	% Pyrolyzed	× COHP ^C	0 ₂ (6c) ^d	p(05) c00	p(29) 02	c02	e 00	н ₂ 0е	HCNe	HFe	нсте

Number in parentheses indicates percent degradation by weight. Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed. a a

Carboxyhemoglobin analyses were performed only on animals dying in the charber. GC samples were taken at 0, 15, 30, 45 and 60 minutes after pyrolysis/combustion and data indicate percent by weight at these times. o o

Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan. Used in LDso calculation. ω*

f Detector tube readings suspect due to possible pump malfunction g Sample lost

SUMMARY: MSTL Pyrolysis/Combustion Studies Sample Y-7685 (Vonar 3 on N W Polyester) Table 8 (Continued)

-			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Sample wr.	4.03 giii			
Group	72			
Cumulative Mortalityb	4/4, 4/4, 4/4			
% Pyrolyzed	66 f			
x cohb ^c	74%			
_p (29) ⁷ 0	13.7/14.4/17.9/15.1/16.8			
co ² (cc) d	2.26/2.13/1.86/1.28/1.15			
_p (၁၅) 0၁	0.41/0.37/0.34/0.23/0.21			
co ₂ e	nt			
a 00	0.2%			
н ₂ 0е	5 mg/1			
HCNe	3 ppm			
НFе	-0 O.l ppm			
HC1e	-0 2.5 ppm			
a Number	in parentheses indicates	percent	degradation by weight.	

b Mortality expressed as number of animals dying in chamber, within 48 hours, and within 14 days per number of animals exposed.

d GC samples were taken at 0, 15, 30, 45 and 60 minutes after pyrolysis/combustion and data indicate percent by weight at these times.

• Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan.

LIST OF ABBREVIATIONS USED IN HISTOPATHOLOGY SUMMARIES

CISW				•		٠	•		٠	٠			•	•	Cloudy Swelling
Comp					٠	٠	•				•	•		•	Compensatory
Cn1b			•		•		•		•		•	•			Centrolobular
Cong			٠		•	÷	•	•		•	•	•			Congestion
Cort	•		•	•	•	٠	•	•	•				•		Cortical
DiSn		•	٠	٠	٠		•				٠	٠		•	Dilated Sinusoids
Ditn	•	•	•	•			•	•	•	•		•	٠		Dilatation
Ed		•	•	•	•		•		•	•		٠	•	٠	Edema
Ersn	•	•		•	•	•	•		•	•	•	٠	٠	•	Erosion
FtCh	•	٠		•	•	٠	•	•	•	•	•	•	•	٠	Fatty Change
Hem	•	•	•	•	•	٠	•	•	•	•	•	•	•	•	Hemorrhage
HypF	•	•	•	•	•	٠	٠	•	•	•	•	•	٠	•	Hyperplastic Follicles
HyCh	•	•	•	•	•	•	•	•	•	•	•	•		•	Hydropic Change
Iflt	•	•	•	•	٠	•	•		•	•	•	•	•	•	Infiltrate
Infl	•	•	•	•	•	•	•				•	•	٠	•	Inflammation
Lum	•	•	•	•	•	٠	•		•	•	٠	•	•	•	Lumenar
Med	•	•	•	•	•	•		•	•	٠	•	•	•	•	Medullary
Muc	•	•	•	•	•				•	•	•	•	٠	•	Mucosal
Муос	•	•	•	•	•	•	•	•	•	•	•	•	٠	•	Myocardial
NS	•	•	•	٠	٠	•	•	•	•	•	٠	•	•	•	Not submitted
Pfol	•	•	•	•	٠	٠	٠	٠	•	•	•	•	٠	•	Perifollicular
Ptrc	•	•	•	•	•	•	٠	٠	•	•	•	•	•	•	Pertracheitis
Sup	•	•	•	•	•	•	•	•.	•	٠		٠	•	•	Suppuration
Thyr	•	•	•	•	•	٠	٠	٠	٠	•	•.	•	•	•	Thyroidization
Trch	•	•	•	•	•	٠	٠	•	٠	•	٠	•	•	•	Tracheitis
Ulcr	•	٠	•	•	•	•	•	•	•	٠	•	•	٠	•	Ulceration
WNL	•	•	•	•	•		•	٠	•	•	•	•	•	•	Within normal limits

Table 9

ett. trakitation

HEART TRACHEA WWL WWL WWL ESSW/F/L WWL WWL	TRACHEA L WWL FTCH WWL FTCH WWL FTCH WWL FTCH WWL FTCH WWL FTCH	GY SUMMARY NWL WWL FTCH/B/2 FTCH \$ C1.5 M, CN.CB/ B /2 C1.5 M, CU.CB/ C1.5 M, CU.CB/ FTCH \$ C1.5 M, CN.CB/ FTCH \$ C1.5 M, CN.CB/	CONG/A/DI WARD CONG/A/DI WARD CONG/A/DI WARD WARD WARD WARD WARD WARD WARD WARD	Alpli	AROLYSIS PROCEDURE ADRENAL WNL Clear cells in meduls WNL
Sample Sample HEART TRACHEA 5.00 Sarbeige WNL WNL 10.00 Sarbeige WNL East/F/1 10.00 Sarbeige WNL WNL 15.00 CHAMBER WNL WNL	HEA		SPLEEN ONG/A/D/2 CONG/A/D/1 CONG/A/1 CONG/A/1		ADRENAL WNL Clear cells in medulb WNL
5.00 SACRIEGE W N L WN L 10.00 SACRIEGE W N L ESW/F/1 10.00 SACRIEGE W N L ESW/F/1 10.00 SACRIEGE W N L WN L			ONG/Alo/2 CONG/Alo/1 WNU CONG/Al/	1 1 1	Clear cells in medules WNL
5.00 SACRIEGE W.N.L. ESW/F/1 10.00 SACRIEGE W.N.L. ESW/F/1 10.00 SACRIEGE W.N.L. W.N.L. W.N.L.			CONG/A/I	7///\	WAL
10.00 Secrifice W.W.L. Essu/F/1 10.00 Secrifice W.W.L. W.W.L. W.W.L. W.W.L. I.S. OOCHAMBER W.M.L. W.W.L.			CONG/A/I	WN	WAL
WW JWW			WNL CONG/A/I	//M	
15 OOCHAMBER WALL WALL			CONG/A/I		NW
			CONG /A /!	7//M	WWL
				MED CONG/A/2	7NM
Cours 14 10 /1 Mue FRSW /F	-1	WNC	WMC	WWC	7N/M
Lym Sur /A /3	2	7///	WNC	HEM/A/4	7WW
WIN Mis France		FrC4/b/1	WWL	WNC	WWL
5 N ///M		FTCH/D/1	WNC	WNC	DISM (MED)
WN L Muc Uce		7 <i>W</i> M	NNC	MML	7/V/A
NW JWW		WWL	WAL	WWC	7////
WW.		WNL	WNL	WWC	NNT
WN ERSH / B		WW.t.	WWL	WWC	WWL
TNM TNM		WWC	WWL	7NM	WWL
WNL WYC		MWL	WNC	WWL	WWL

F= FOGAL, 1= MILD, 2= MODERATE, 3= SEVERE, 4= MASSIVE LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY SUMMARIES. D= DIFFUSE, REFER TO Key: A = ACLITE, C=CHRONIC,

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2	Supurated VASCULTIS			C/F/2	C/F/1	}	1			1/2/0	2	<i>C/0/1</i>	1	1				1	c/0/2	10/10/10	
JURE	U PUCATOR						1	1					1				1		1	า	
PROCEI PNEUMO-	NITIS		/F/1	-	C/F/I	C/E/1	C/F/I	C/E/I	1			-	ļ			1	2/9/5				
	Preurity 1		7	-	<u>)</u>)	<u>)</u>	1		†						1	1				
IN CHAME PYROLYSIS Periston:					1			1	C/E/22	1,42	D/2	10/2				1/ <i>0/</i> 5		01-12	1/4/4	10/23	
			1		<u> </u>		-		ار		0/2	c/b/2 c/b/2			7.1/0/5			١		C/D/2-3/C/D/2-3	
LUNGS ONLY)	EMPLYZEMA HEYDERHAZ MATION CHIDLITIS	<u> </u> 				<u> </u>	-			1	<u>a</u> 	9) 	<u> </u>		-	+	2	
	Critice IMA	 		-	AIC/D/4	-	A/F/2 -	<u> </u> -		<u> </u>	<u> </u> -			<u> </u> -	A/D/3 .	1	- 	-	<u> </u>		
ARY -	EMA HEYDI	<u> </u>		- AKC	1	- A/F/1	- A/				 	17				<u> </u>		+	<u>'</u>	3	
SUMMARY 1		~				2	12				 	F-1/U		<u> </u>	 -	1				- 10/1-3	
	I EDEMA	A/D/				A/0/2	A/0/2	T	+		-		+	<u> </u>	 				1		
ATHOL Durate	DROWCH!										1		-	1	-				<u> </u>	1	
HISTOPATHOLOGY	CONGESTY	AM		1	1	4/0/2	4/0/2	7				· winter					7		2		
I	PHUMONIA CONGESTION DEONCHI		1		1	1			!]		,	A/D/3	C/D/1-2A/F/3	C 1512		Arc/r/5	AC/D/3)	
	REDNITHING					1				2/F/1				1	2-1/0/-	1/4/0		7/00	C/F/2	A/3	
Po A	Ĭ	Τ,																2/0/2(10/2		A/3	
Y-7683 (L5-200 Foam)	ATELEC-BRONCH	2				122	17/1	1	D/2	-							1				
\ <u>.</u>	A I	1 - X		1	\parallel		- 			<u> </u>		\parallel		4/3		-	1		-	A/3	
683		N N	FICE	33136		33731	MBER	1868	RIFKE		ZIFICE ZIFICE	RIFICE	. Joiet	33,21		SIEICE.	RIFICE	RIFICE	Aveo	┼	24.74.7
7-7		_	5.00 SEKRIFICE	5 00 Sacuetce	00	3 300	00 00	OOC	00 5~	2	345	200	OOSec	-00		2500	OOS	oosse	Dec		֓֜֝֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֓֓֓֓֓֜֜֜֜֜֜֜֜֜֜֜֜֜֓֓֓֓֓֜֜֜֜
	ANCTH WEIGHT	F C C F	-		12995 10 00 SAURELLE	12946 10 00 SARIFICE	12921 15 00 CHANBER	12922 15.00 CHAUBER	13071 15 00 SARIFKE	100	150 /2 15 . UU SAGRIFICE	13113 2000 SARINGE	13114 20.00 SAXIFEE	A 130 25 00 500 51 51 51 51 51 51 51 51 51 51 51 51 51	7	(3129 25.00smarrice	13131 3000 SACRIFICE	13137 30.00 SACRIFICE	12120 EO OO SELAVER	13130 00 00 00 00 00 00 00 00 00 00 00 00 0	7
	MCT	2	12943	12944	1299	1294	1292	129	130	1	20	131	13	121	7	131	131	4		7 7	***
			١	ı																	

KEY: A=ACUTE, C=CHRONIC, D. DIFFUSE, F=FOCAL, 1=MILD, 2=MODERATE, 3=SEVERE,

NOTE: A DASH INDICATES THE LESION WAS NOT OBSERVED IN THAT ANIMAL

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>	-768	4 (%	WAR 30	Y-7684 (YOWAR 3 ON FIBERGLASS)		HISTOPATHOLOGY SUMMARY (EXCLUDING LUNGS)	ARY (Excludit	VG Lungs)	IN CHAMBER PROLYSIS PROCEDURE
Ì	#LSW	SAMPLE WEIGHT (GRAMS)	DEATH	HEART	TRACHEA	LIVER	SPLEEN	KIDNEY	ADRENAL
	13134	10.00	13134 10.00 SACRIFICE	MNL	Muc Ersy /F	FTCH/D/1	WAL	WNE	WNL
-4, ,	13135	00.01	13135 10.00 SACRIFICE	WNL	NS	FTCH/p/I	WWL	WKL	WNL
***************************************	13455	2000	SACRIFICE	13455 2000 SACRIFICE CONG \$ ED/A/D/1	TRCH /C/F/1	CONG/A/D/I	WWL	CL.Sw/D/1	WNL
- <i>F</i>		20.00	SACRIFICE	1345620.00 Sacrifice com6 & ED/A/D/1	TRCH/C/F/1	FTCH/D/1	WAL	7 1/14	WWL
V	13457	30.00	1345730.00 Sacrifice consted	ανς¢ΕD/A/D/2	TRCH /C/F/I	FTCH/D/I	WNL	CLSW/D12	WNL
∀ 1≥	\$ 13458 30.005xx1110E	30.00	SACRIFICE	WAL	TRCH/C/0/1	WNL	WRL	WAL	WNL
3L. '	13127	40.00	13 127 40.00 1 DAY	CONG \$ED/A/D/I	WN C	CONG/A/D/I	WW. L	CLSW/D/1	WNL
	13138	40.00	SACRIFICE	1313840.00 Scrifice ED & Dray /D/1	MUC ERSWIF TRCH (C/D/F	FTCH/D/I	WNL	WNL	WNL
	13139	40.00	313940.00 SACRIFICE	WW L	MUC ERSN/F TRCH/C/D	FTCH/D/I	WWL	WNL	WNL
	13463	10.00	13463 10.005 KRIFICE	WNL	NS	MWL	WW2	WHL	WNL
	13464	10.00	13464 10,00 SMRIFICE CONG/A/	CONG/A/F/3	WNL	WNL	WWL	אאר	WNL
	13465	20.00	13465 20.00 SACRIFICE	WWL	フルM	CONG! ED/A ID/I	WNL	WWL	MNL
2	13466	20.00	13466 20.00 SACRIFICE	7 <i>NM</i>	MUC ERSH /F TRCH /C	WNL	WNL	MNL	N/N
1 0 15	\$ 1346740.00\$kRIFICE	40.00	SKRIFICE	WWL	TRCH/C/D/1	FTCH A/b/I	WNL	WNL	WNL
<u></u>	13468	40.00	13468 40.00 SARIFICE	MNL	TRCH/C/D	FTCH/D/Z	WWL	HrG	MED CONS/A
	13469	56.56	13469 56 .56 SARIFICE	NN L	TRCH/C/D/1	WNL	WNL	WWL	WNL
	13470	56.56	13470 56.56Sacrifice	WWL	MML	WNL	WWL	WNC	WNL

2=MODERATE, 3=SEVERE, |=MID, F= FOCAL, KEY: A=ACUTE, C=CHRONIC, D=DIFFUSE,

NOTE: REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY SUMMARIES

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A South	I/a	C/F/I			1.	1	1		c/p/i			CFF/I	1		1		1
DURE Spreatow Assurps		1						1	1			1	1		1		1
PROCED PNEUMO- NITIS	C/F/I				C/F/1-2	CFI	CFI	AIC/F/I	CF11-2			1	c-1/q/2	1/9/5	c/b/2		c/b/r2
OLYSIS PROCEI PEURITS PREUMO-		1				j	1	1	1	1		1	1	1	1	C/F/2	1
R PYRO	c/0/2	JF/12		1	C/E/I	1/4/2		2/0/2	1	1		1	1	c/F/I	1	C/F/1	1/2
IN CHAMBER PYROLYSIS PROCEDURE INFLAM- PERIBON/PERISON PELIRIES PRELIND-SUPPORTS PRELINDS SUPPORTS	c/b/2 c/b/2	C/F/I-2 <i>C/F/</i> I-2		1	CFI	C/F/I (1		1		I	1		-	1	1/0
IN-ZAM-		1		1	1	1	1	1	1	1	1	1	1	1	1	İ	1
	A/D/3	1	A/D/3	A/D/3	A&C/1-2		1	F/F2	1	1	1	1	1	1		1	
(LUNGS ONLY)		F/I		1	F/2	1		F/I-2	I/a	OLITE ROP		1	J/0	1	1	1	1
EMA		1	A/D/3	A/D/3	Aic/1-2	-	1	F/I-2	1	A/D/2-3	A/D/2-3	A/D/2-3	<u> </u>	A/D/2-3		1	A/0/2
<u>u</u>				Ì	4	1	1	1	1	-	1 -	1	1	1	1	1	<u> </u>
GY S	1		A/0/3	A/D/3	A&C/1-2	1		F/I-2	1	A/D/23	A/D/2-3	A/D/2-3	J/a	A/D/2-3	1	1	A/D/2
ATHOLO BRONCHO- BRUMOWIA					1		c/E/1	[1	<u> </u>	C/F/1	/	1		1	C/F/1	1
ISTOP.	1			1	1			1	1			1	1	1			
BRONCHI- OLITIS	1		1	1	1		1	1	c/0/2	1	1		1	1	1	1	
RGLASS) ATELEC- TASIS			F/2	1	1	1	0/2	F/I-2	1	1	1	1	1	1	1	1	1
ON FIBE					1		1	1	1	1	1	1	1	1	1	1	1
DEATH	SACRIFICE	SACRIFICE	SACRIEKE	Sacrifice	SACRIFICE	SACRIFICE	DeLayeo	ACRIENCE	SKRIFICE	SKRIFICE	ACRIETCE	PRIBLE	KRIEKE	- AERIEICE	ACRIEICE	ACDENCE	ACRIEKE
34 (VI	10 00	10.00	20.00	20.00	30.00	30.00	40.00	40.00	40.00	10.00	00.01	20.00	20.00	40.00	1000	56.56k	56.56k
Y-7684 (VONAR 3 ON FIBERGLASS) HISTOPATHOLOGY SUMMAI MATH MELEC- BROWGHTS BROWGHO BROWGH BROW	13134 10 DOSACRIFICE	13135 10 005 KRIEICE	13455 20 00 SACRIEKE	1345620.00Sacrifice	-1345730.005kgieice	13458 30.00 SARIFICE	\$13127 40.00 PENYER	13138 40.00 SACRIFICE	13139 40.00 SKRIFICE	13463 10.00 Sequence	13464 10.00 SARIFICE	13465 20.00 SKRIFICE	1346620.005kgleke	7 13467 40.00 Swarping	- 13468 40.00 Sections	13469 56.56Sacrifice	13470 56.56 Seriere
-					· ¦	4	Αľ	ЯŢ	7			z	7	115	正-	_	7
(3)											٤	3					

3= SEVERE, F = FOCAL, 1= MILD, 2 = MODERATE, KEY: A=ALLTE, C=CHRONIC, D=DIFFUSE,

NOTE: A DASH INDIC, THE LESION WAS NOT OBSERVED IN THAT ANIMAL

* POSSIBLE FOREIGN BODY DEBRIS

- 4- XIII

CEDURE				1						1					:
HISTOPATHOLOGY SUMMARY (EXCLUDING LUNGS) IN CHAMBER PYROLYSIS PROCEDURE	ADRENAL	WNL	CONG/A/D/I	CONG/A/D/1	7/1/1	WML	CONG/A/D/I	CONG/Alo/1	CONG PAID/1	WWL	CONG PAID 12	Com6/A/D/1	7WW	WWL	WWL
ic Lunes) IN CHA	KIDNEY	CL SW 10/1	CL. SW/D/1	CL SW/0/1	CL Sw/0/1	WNC	CL 5w 1D /! MED CONG /P /2	CLSW/D/I	CLSW/D/1	CLSW/D/I	CL. Sw/D/1	MED CONC/A/2	CLSW/D/1	7 <i>W</i> M	7 <i>N</i> M
ARY (EXCLUDIN	SPLEEN	WNL	WNL	MNT	WNL	MN2	WNL	TNM	WWL	W/ML	WNL	WWL	7////	MNL	I WALL
огоех Ѕамм	LIVER	WNL	WNL	CONG/D/1-2 F7CH/D/1	MNL	CONG /AID/I	CONG /A/10/2	CONG/A/D/I	FG/0/1	WNL	CONG/A/D/1 F-CH/D/1	FTCH/D/I	WWI	FTCH /D/1 CONG /A/D	FTCH/15/1
Ніѕторатн	TRACHEA	TNM	7NM	TRCH/C/D/1	TRCH/C/D/2	7//M	7NM	Muc Ersn /F	MucERSN/F	7 NM	MNL	TRCH/C/D/1	TRCH /C/F/1	MucErsn/F TRCH/C/ F. Cong & HEM/D/2	TRCH /C/2
VW POLYESTER)	HEART	WNL	WNL	CONG EED/AIDI	CONG \$ED/A/D/I	ED/A/D/1	CONG ∉ED/A/D/I	1314120,00 CHAMBER CONG & ED/A/D/1 MUCERSN /F	WNL	CONG FED /A/D/I	CONG (ED/A/D/2	CONG FED/A/D/1	1/0/03	WW L	WWL
Y-7685 (VONARS ON NW POLYESTER)	SAMPLE WEIGHT DEATH	13309 10.00 SACRIFICE	13310 10.00 SACRIFICE	13 142 14. 14 CHAMBER CONG (ED/A/D/)	13307 14. 14 SACRIFICE CONG \$ED/A/D/1	13308 14,14 SACKIFICE	13140 20,00 CHAMBER CONG (ED/A/D	20,00 CHAMBER	13305 20,00 SARIFICE	13306 20 00sagifice Colletto/A/D	13 43 28.28 CHAMBER CONG & ED/A/D/2	13/44/28,28 CHAMBER CONG (ED/A/D/)	133112828BKE	13 136 40,00 CHAMBER	13137 40.00 CHMBER
₹-7685	MST# KEIGHT	13309	13310	13 142	13307	13308	13140	13/4	13305	13306	13143	13144	11221	13136	13137

3= SEVERE, 1=MILD, Z=MODERATE, KEY: A=ACUTE, C=CHRONIC, D=DIFFUSE, F=FOCAL,

REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY SUMMARIES. Note:

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MECUITES				C/F/I	1,			CIFIL						C/E/I
DURE				1	1	1	1							1
PYROLYSIS PROCEDURE SHOW FILE PURITY SUPPRINTS	c/F/1-2	c/r/ı		C/F/1	c/F/I				1	1		C/F/2		Atc /F
OLYSIS PLEURINS				1							1			
R PYR	C/p/t	c/F/I	1	c/o/i				C/F/I				D/F12		C/F/I
IN CHAMBER PYROLYSIS PROCEDURE INTAMP SUPERING MEMON SUPERING MEMON PRICES CHITS WITHS SUPERING MEMON SUPERING MEMON SUPERING MEMON SUPERING MEMON SUPERING MEMON SUPERING SUP	cloli	c/F/i)	1			c/F/I				D/F/2		C/F/1
IN C WELAM-	_		1	1			1	1		1				
4 H	Γ.	R/F/I		R/F/2	R/F/2	A/D/2	1	R/F/1	R/F/3			Atc/F/23		F/2-3
(LUNGS ONLY)			}	1				1		1			1	F/2-3
(Lungs O		A/b/2	1		1		1	A/b/2-3	A/D/3	Ì	A/b/3	A/D/2	1	F/2-3
Z =			1	1	1	1						1		
ATHOLOGY SUMMARY GROWN CHO LOGSTID PILATION PROMOTING TO PROMOTING TO PROMOTING TO PROMOTING THE PRO		A/D/2	1					Afb/2-3	A/b/3	1	AfD/3	A/D/2		F/2-3
THOLOG'		1	1			1	1			1	1		1	
HISTOPA BRONCHITIS		1	1		1	1	1	1		}	1			1
BRONCHI-		1		c/b/1		1	1		1		1			
YESTER ATELEC-	F//		1/0	1		D/3	0/3	1	1	2/0	1	1	5-90	F/2-3
NW Pol		1				1				1			1	
NR 3 ON		SKRIFICE	CHAMBES	Carelline	CACBIERE	Service State of the service of the	S S S S S S S S S S S S S S S S S S S	CHAMBEN	ACK FICE	N. Kir ice	Charles	CHANGER	3	CHAMBER
SS (VOWAR 3 ON NW POLYESTER) HISTOPATHOLOGI SAMPLE SOWHI DEATH ABSCESS PAGES OF DEATH PROMOTED PROMOTED PROMOTED PROMOTED PROMOTED PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOMENTS PROMOTED PROMOTE	CGRAMS)	00.00	2 2	14 14	7 7	30.00	31 10 50 00 millions	20.00	2 206 20 00 conference	12 1/2/20 28 CHINE	00000	00.00	12.2.1140.40 MBPICE	1313640.00 CHAMBER 1313740.00 CHAMBER
	# 15W	13509 10.00 SKRIFICE	13310 10.00 Sakirike	13142 14.14 Chamber	1330/ 11.17 Second	121400000	12121	12171	1 5 5 U 5 L U DU SACRIFICE.	27121	12 1 4 7 0 2 0 2 0 2 1 2 1		ווככו	13136
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Key: A=Kute, C=CHROHIC, D-DIFFUSE, F=FOCAL, R=REMOTE, 1=MILD, Z=MODERATE, 3=SEVERE, 4=MASSIVE

NOTE: A DASH INDICATES THE LESION WAS NOT OBSERVED IN THAT ANIMAL

Table 10

17E												ŧ	:	:								
PYROLYSIS PROCEDURE	ADRENAL	WNL	WNL	WNL	WNL	WNL	Μεο ζον6	WNL	MED CONS /A/1	WNL	WNL	WNL	(A/A/A/2/1	MNF	CONG/A/D/1	CONG/A/D/I	WNL	Cong/A/2	Cons/A/D/1	Cons/A/D/1	ConG/A/D/I	
MSTL	KIDNEY	CLSW/F/2 HYCH/F/2	WNL	CL SW/D/1 HY CH/D/1	Cr. Sw/D/2-3	MED CONG/A/2	MED CONS/A/2	CL.SW/D/2 HYCH/D/2	MED CONG/A/1	MEDCONG/A/2	Men Cores /A/2	Ned Gong/A/2 CLSW HYCH/D/2	C.Sw/D/2	MED CONG/A/2	CLSW/D/2	CLSW/D/2	WNL	CLSW/D/2	CLSW/D/2	CLSW/D/1	CL.5w/D/2	•
(Excluding Lungs)	SPLEEN	WNL	Conc./A/D/1	WNL	WN L	WNL	WNL	MN L	WNI	WNL	WNL	WNL	WNL	Prot CONG/A/I	WNC	WNL	WNL	WNC	WNL	WNL	MNL	1
IGY SUMMARY	LIVER	FrG4/D/I	ETCH/D/!	N N I	WNL	CONG/A/D/I	CONG/A/D/2	Frcs./0/1	CONG/AID/I	CONG/A/D/1	CONG/A/D/2	CONG/A/D/I	FTCM/DJ/Z CONG/A/ID/Z	CLSW/D/1-2 CONG/A/D/2	CONG/AIDIZ	Fr Ca /A/D/2 CONG /B/D/2	WNL	CONG/A/D/I	CONG/A/D/2	CONG/A/D/1	CONG/B/D/1	
HISTOPATHOLOGY SUMMARY	TRACHEA	ERSN/D	ERSN/F INFL/C/0/I	TRCH/C/F/I	TRCH/C/F/1	TRCH/C/D/2	1NFL /C/D/2	TRCH (c/p/1-2.	TRCH /C/D/2	TRCH /C/F/1	TRCH/C/D/1	TRCH 1/C/D/1-2	WNL	TRCH /C/D/1	Тяс <i>н/с/D/3</i>	WNL	WNL	TRCH/C/F/1	WNL	ERSN/F TRCH/C/F	ERSN/F TRCH/C/F/I	1
00 FOAM)	HEART	13421 - 3.12 SACRIFICE CONS/A/D/2.	Ep/0/2	WNL	CONG./4/D/1	HEW/A/F/2-3 CONG/A/F/2-3	3.51 CHAMBER CONG/A/F/2	WNL	WNL	WNL	WNL	WNL	13418 4.96 CHAMBER CHG/ED/A/D/2	4.96 CHAMBER CONG/A/D/2	13416 6.25 CHAMMER CONG / A/D/2	CONG /AID /2	13420 6.25 SPCRIFICE CONG/A/F/1	13414 12.50 CHAMBER CONG/A/D/1	13415 12.50 CHAMBER CONG/A/D/1	ED/A/D/I CONG/A/D/I	134135000 CHAMBER CONG/A/D/1	í
Y-7683 (LS-200	DEATH	2 SACRIFICE	3.12 SACRIFICE ED.	331 SACRIFICE	3.31 SACRIFICE	3.51 CHAMBER	1 CHAMBER	3.51 skrifice	3.72 CHAMBER	3.72 CHAYBER	3.94 CHAMBER	13488 3.9 4 CHAMBER	6 CHAMBER	6 CHAMBER	5 CHAMBER	6.25 CHAMBER	SACRIFICE	СНАМВЕР	O CHAMBER	CHAMBER	OCHAMBER	(
83	WEIGHT	3.15	3.12		1	1	35				,	3.9	4.9	- 1	6.2	6.2	6.2	12.50	12.5	50.00	500	
J-76	MST# WEIGHT	13421	13422	13506	13507	13489	13490	13505	13491	13492	13481	13488	13418	13419	13416	13417	13420	13414	13415	13412	13413	*

4=MASSIVE KEY: A=ACUTE, C=CHRONIC, D=DIFFUSE, F=FOCAL, R=REMOTE, 1=MILD, Z=MODERATE, 3=SEVERE,

USED IN HISTOPATHOLOGY SUMMARIES TO LIST OF ABREVIATIONS Note: REFER

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PYROLYSIS ROCEDURE. EUBRON PEURITS MEMOURS SOFONION MEMORITS	OF!	Claliz	CIFI	CIEI	CIFIL	CIFI		C(F/I	CIFI	clota	CIFII	1	CIFII	1		CIFII					
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PYROLYSIS PRESENTS CHITIS		CF	1/0		5,0123			C/F/2	1	}	1		1	1	1				C/D/2		
MSTL		CIF (l/a		<u>Q</u>			<u></u>				1	C/F/I	1		C/F/2			Cfb/2 c		
NFLXM- F							1	e accurates		:x=:1>			<u>၂</u>			ر 					
WORKSTON, NY	F/2-3 -	-1/-	F/2 -	A/F/1-2! -		AJF/2-3	A JF/23 -			- 1/0/F		<u>'</u>	A/0/I	<u>'</u>	<u>'</u>	A/D/1 -	<u>'</u> 		<u>'</u> 		
LUNGS ONLY EMPHY HEMOR-	- E	- \A/F/I	— F.	X		– !A/#	– IA/	 - - -) 	- A/		 	- A/		 	- A/	<u> </u>	 			
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SUMMARY ODATION EDEWI]					1		-		-	A/D/frz	A/b/3			A/D/2			A/D/23		A/D/I	
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CONSESTI	F/2-3		F/2	A/F/12	A/0/2	NF23	A/D/2-3	A/b/1	A/D/F2	A/D/2	Af5/1-2	A/0/3	A/b/I	A/D/2	A/D/2	1/ <i>a/</i> 4		A/D/2-3	1	A/D/I	
TOPATHOLOGY SUMM, INTERPREDICTION OF SECULIARIES OF	1	}		1	123 ARC/F/3	-			1	1			1	-	1	C/F/I	1			-	
Н 1STOP Васмонтия		1			Atc/0/23	C <i>F15</i> -3	1	C/F/Z										_			
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. 1	1				F/2-3	F/2	F/I	D/1-2		1/0		F/2-3	F/3	Ω	-	F/2	F12-3	-	D/3	D/3	
OO F		1		1	1	1	1	1	1	1	Į	1		1	1						
(LS-2	3.12 serence	3.12 SACRIFICE	SACRIFICE	3.31 sagince	3.51 CHAMBER	3.51 CHAMBER	3.51 SACRIFICE	3.72 CHAMBER	CHAMBER	3.94 CHAMISER	3.94 CHAMBER	4.96 CHAMBER	4.96 CHAMBER	6.25 CHANBER	6.25 CHAMBER	6.25 sweete	CKAMBER	CHAMBER	CHMBER	CHAMBEE	
SANITE WEEKET	3.12	3.12	3.31	3.31	3.51	3.51	3.51	3.72	3.72	3.94	3.94	4.96	4.96	6.25	6.25	6.25	2.50	12.50	50.00	20.00	•
Y-7683 (LS-200 Foam) MST# (Жарыт) DEATH (ABSCESS ARELE-	3421	13422	13506	13507	13489	3490	13505	13491	13492 3.72 CHAMBER	13487	13488	13418	13419	13416	13417	13420	1341412.50 CHANSER	13415 12.50 cmsex	1341250.00 CHANSER	13413 50.00 CHANSER	
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4=+4SSIVE I=MLD, Z=MODERATE, J=SEVERE, KEY: A=KUTE, C=CHROHIC, D=DIFFUSE, F=FOCAL, R=REMOTE,

NOTE: A DASH INDICATES THE LESION WAS NOT OBSERVED IN THAT ANIMAL.

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MSTL RROCYSIS PROCEDURE	ADRENAL	WNC	Med Cort Cons/0/1	WNL	WNL	WNL	MED CONG/D/I	WNL	WNL	WNL	CONG/A/D/2	WNL	WNL	WNL	WNL	WNL	MEDCONG/A/I	WNL	WAL	MEJCONS/A/I
	KIDNEY	CLSW/D/2 HYCH/D/2	CCSW/D/1 HYGH/D/1	MED CONG/A/1-2	Cc.Sw/A./O/1 HvCw/A/D/1	CCSW/A/D/1 HYCU/A/D/1	MED CONS/2-3 CLSW/D/2	MED CONG /A/2	CuSw/b/2	MEDCONS/A/2	Μευ <i>(</i> ΟΝ:5/Α/2 CCSw έΫτΩ/ ()/2	MED CONS /A/D/2	Ct. Sw/D/2	C.Sw/D/2 HYGJ/D/2	MED CONS/A/2	MED CONG/A/3	MED CONS/A/D/2	MED CONG/A/3 C.SwfHyCy/D/2	MEDCONG/A/2	MEDGONG/A/2 CLSW CHTCH/D/1
EXCLUDING LUNGS)	SPLEEN	WNL	PFOL CONS/A/1	PFOL CONG/A/I	PEOL CONG/A/D/I	PEOL CONG/A/D/I	WNL	Proc Cons/A/D/1	MNF	WNL	WNL	PEOL CONS./A/2	7N/A	MNE	WNL	WNL	Proc Cons/A/D/	WNL	PFOL CONG/A/I	WNL
Ніѕторатногову Ѕиммаку	LIVER	WNI	WNL	CONG/A/D/1	WNL	WNL	CONG/A/D/2	CONG/A/D/2	WNL	Cons/A/D/1	CONG/A/D/2	WNL	WNL	WNL	CONG/A/D/2	CONG/A/D/2 F-CH/D/2	WNL	Cons/A/DIS	Cons/A/b/1	WNL
Ніѕторатно	TRACHEA	Твен/С/D/1	TRCH /C/D/1	TRCH/C/D/2	TRCH/C/D/I	TRCH/L/D/1	ERSN TRCH/C/D/2	ERSN TRCH/C/0/2	Submuc Hem/A/2 TRCH/C/F/I	TRCH/C/D/I	TRCH/C/E/1	TRCH/C/1	TRCH/C/F/1	TRCH/F/1	TRCH/C/D/2-3	TRCH/C/D/2	TRCH/C/D/2-3	INFL C/D/2-3	TRCH/C/D/2-3	TRCH/C/D/1
Y-7684 (YONAR3 ON FIBERGLASS)	HEART	WNL	WNL	WNL	WNL	WNL	WNL	WNL	WNL	WNL	WNL	CONG/A/F/2	WNL	WNL	CONG/A/F/I	CONG/A/F/1	WNL	WNL	WNL	WNL
VONAR3	ДЕАТН	2.45 SACRIFICE	2.45 SACRIFICE	2.60 CHAMBER	2.60 SKRIFICE	2.60 syraerce	2.76 CHAMBER	2.76 CHAMBER	2.76 SACRIFICE	2.93 снамвек	2.93 CHAMBER	2.93 CHAMBER	2.93skrifice	2.93 SACRIFICE	3.11 CHAMBER	3.11 снамвек	3.30 CHAMBER	3.30 CHAMBER	3.50 CHAMBER	3.50 CHAMBER
94	WEISHT (GRAMS)	2.45		- 1	- 1	2.60	276	276	276		2.93	2.93	293	2.93	3.11	3.11	3.30	330	350	- 1
Y-76	MST#	13526	13527	13502	13520	12521	13500	13501	13517	13503	13504	13497	13511	13512	13498	13499	13495	13496	13493	13494

A=MUTE, C=CHRONIC, D=DIFFUSE, F=FOCAL, R=REMOTE, J=MILD, Z=MODERATE, 3=SEVERE, 4=MASSIVE NOTE: REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY SUMMARIES Key:

WSGRLTTS					C/E/I							-	1							
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oure Pendutagnana (Medutis		CFF		C/F/I	CFI	C/0/1	C/F/I	C/F	CÉM	C/F/I		C/F/I		C/0/1	1/95		Arc.fe.fe.5			
PROCED LEUZITES							1		1		1					1		١		
Pyrolysis Procedure			E3/0/>			1		1		1		1	1	1	1		GFf23		1	
PYRC STIBBOATS					1		1				1			1					1	,
MSTL Pyrolysis Procei			1		l							1	1	1				-		1
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r Sum	A/D/2	1/0/	V0/1-2	A/F/3	A/D/3	A/0/2	A/D/2	A/D/2	A/D/Z	A/D/1	A/D/I	M0/1-2	N/Q/A	A/D/2	Aloks	Mb/F2	4/b/1-2	A/b/1	MD/2	•
TOPATHOLOGY SUMMARY FIII- BEXTHAL DICESTON BOLATION		C/F/1 A/D/1	2-3 Arc/F/2 A/D/1-2		Ī	1		1	A/F/2	1		1	1		1	1	C/F/1 A/b/1-2	1	1	
HISTOPATHOLOGY		AC/F/1	C0/23	1		1		1	1			1			1		CFF2	1		
FONCHI-		1	1	1	1			1	1				1	1	1	1	Ī	1	1	
ERGLASS	F/3	F/2	1	1	1	F/2	F/2	D/2	F/2	E/2	1/1-2	F/2	1/-1/-3	1	1	D/1-2	=/5	F	2-1/0	
ON FIBE		1	1	1	1	1	1	1		1	1	1	1			1	1		1	
NAR 3 DEATH [MAIRE	ACKIENCE.	C CO C	A CONTRACTOR	a Santa	276 Cuamere	2.76 caralleen	201210	2020000	rwmoek	2 92 Cawasex	2.73 SACRIFICE	Z 2 2 3 2 2 1 1 Z	A I I Consider		7 7 C C C C C C C C C C C C C C C C C C	7 EO (1111)	250 CHAMINER	
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Y-7684 (VONAR 3 ON FIBERGLASS) HISTON ANCTE SAMPLE DEATH MESCESS ATTELEC TROYEN BONGS	100.1	132CB	77661	12520	12521	12500	12501	12517	12502	I ZEON	1200H	1247	1001	200721	12400	12/05	12706	12402	13494	1
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Key: A= Acute, C=Chronic, D: Diffuse, F= Focal, R= Remote, I=MILD, Z= Moderate, S= Severe, 4= Massive NOTE 1: A DASH INDICATES THE LESTON WAS NOT OBSERVED IN THAT ANIMAL

SUMMARIES NOTE 2: REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY

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	i G	N N									O	9					OF	PO	OR	QUA	LIT	Y		
	L Pyrolysis Breening	ADRENAL	WNI	NNI	WNL	MED! Corr (A/1	WNL	WNC	MEDICORTCONS/A/DZ	MNL	WNL	MED (CORT CONG/D/2	MEDICORTCONG/D/2	WWL	WNL	CONG/A/D/1	WNL	WNL	WNL	WW	WNL	WNL	WNL	WNL
	(Exampling Lungs) MSTL	KIDNEY	0/1 CLSW/0/2	 		CLSW F HYCH/D/1	CLSW FHACL/D/1	CL. Sw & Hy Cn/D/1	5/8/2	NS	CLSw/HYGu/D/	- }		CL Sw f Hv Cu/D/1	Gowell Mrs	CLSW EHYCHIDE	NS	Men Com Colo	MED CONSIGH	CLSWEHYCH/D/1	MED CONG/A/2	MED CONG/A/2.	C. Swithran/D/2	C-3WEHYCH/D/2
٠٠)			1 Per Cous (A/D/)		1	/i WNL	WNL	MN2		JA(N)				JN M	g 	W N L	Processor 1472	WNL	WNC	WNL	WNL	PROLCONG/A/1 MED CONG/A/2	WN	
() () ()	HISTOPATHOLOGY SUMMARY TRACHEA LIVER			+	(E/1 W/N L		WNL VALNI		\dashv	_	1-2 CONG/A/D/2-3	-	WN		<u>.</u>		FrCy/F/1	CONSIMPLE	-	-	Cons/4/D/2-3	CONS/A/D/1-2	Coric/A/D/z	R=REMOTE I
	 -	月	-	+	+	Teculo/o/		TRCH/AtC/D/2	TRCH/C/F/1		+	12 TRW/A/0/2-3	NS	TRCH/C/D/	TRUNCID/2	TRCH/C/DA	SN	TRCH/C/D/1 ERSN	TRCH/C/0/1	TRCH/AIC/DA	TRCH/C/F/1	TRU/C/D/1-2		F= FOCAL
7 KILL D	MST# GRANS DEATH HEART	2.00 SACRIFICE W.N.L.	CO SWRIDGE WAL	2.52 SACRFICE WILL			2.68 SIN RIFICE WILL			7 OI CHILL	,	Ś		ACRIEICE WINL	HAMBER WNL			AMBER WAL			MINGER WINE			HRONIC, U. DIFFUSE,
Y-7685 //	MST#WEIGHT	13524 2.00]	1 1	13523 2.68	- 1	15545 2.68	.	1	1		1		1		1	13515 3 30 CHILLIAN	1 - 1	13539 338 SACRIFICE	· 1	13514 3.58 CHAMBER	13510 402 CHAMBER) / I I I I I
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fuse, F=focal, R=remote, I=mild, 2=moderate, 3=seyere, 4=massive SUMMARIES NOTE: REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY

Wedness								C/F/I							C/E/I					1						
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SCHWATTS	71.0	25.5	QF/	C/E/I	CFF		1	C/F/1	c/b/i	C/F/I				C/E/1	1/2	}		C/F/I		١	C/F/I	1	1			
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(Von	WEICHT (GRAMS)	700 0		0 10	7 7 7	200	0 0	2 d c	व व	200	2007	HO N	S N	100	201	700	1.	1	1	1		1	4 50	1		د ا
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KEY: A-ACUTE, C-CHRONIC, D-DIFFUSE, F-FOCAL, R-REMOTE, I-MILD, Z-MODERATE, NOTE I: A DASH INDICATES THE LESION WAS NOT. OBSERNED IN THAT. ANIMAL

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NOTE 2: REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLOGY SUMMARIES.

original page is of poor quality,

Table 11

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	HBRONCHO-CONGES- DILATION EDEMA ENAMP HENOR- INFLAM CHICITIS CHITIS TREURITS THEURING TION BRONCHI EDEMA RHAGE MATION CHICLITIS CHITIS THEURING THE STANDARD TOOL BRONCHI EDEMA		-	1			1	
\mathfrak{T}	CUPERATION							
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(Lung	REURITS	1		1	-		}	
	PERBROH- CHITIS	1/0/2	C/E/1	C/E/J	(<i>C/E/</i> 1	1	C/D/I	1
1ARY	PERIBRON- CHIOLITIS	C/D/I	C/E/I	C/E/I	C/F/1	1	c/p/1	
Sump	INFLAM-		}	1		,—	1	
)GY	HEMOR- RHAGE	1	A/F/2-3	A/D/23	8-7/D/Y	A/D/4		A/F/2
HOLC	EMPHY- ZEMA	1	-				1	
PAT	EDEMA	1	F/I-2	A/E/1	A/F/1		1	
HISTO	BRONCHI		1	1				
	CONGES-	A/D/I	F/1-2	A/F/I	A/F/1	1		
	BRONCHO	C/E/I	1				1	
TRO	BRONCHI)		1		1		1
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MST#	HEART	TRACHEA	IIVER	SPIFEN	KIDNEY	ADRENAL
13532	13532 Mroc INFL/C/F/1	TRC4/C/D/1	WNL	WNL	WNL CLSW{HYGH/D/2	WNL
13533	WNL	ERSN TRCH/C/F/1	WNL	WNL	CLSwfHYGJ/D/1	MNL
13534	3534 CONS/A/F/1	ERSN TRCWC/D/I	FTCH/F/1	WNL	CLSW HYCH/D/2	WNL
13535	3535 CONG/A/F/1	ERSN TRCH/C/D/I	FTCH/F/1	WNL	CLSW! HYCH/D/2	WNC
13536	3536 WNL	TRCWC/D/1	WNL	WNL	CLSW/D/1	WNL
13537	WNL	TRCH/AtC/D/2	WNL	PFOL HEM/A/I	PFOL HEM/A/1 G.SW CHYCW/D/1	WNL
13538	3538 HEM/A/F/1	NS	MNL	WNL	WNL CSWEHYGH/D/I WNL	WNL

F=FOCAL, R=REMOTE, I=MILD, Z=MODERATE, S=SEVERE, KEY: A-ACUTE, C-CHRONIC, D-DIFFUSE, Note 1:

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Table 12

General Summary of Gross Autopsies and Apparently Exposure-Related Features - In-Chamber Pyrolysis

	12		
Histopathologic Examination	The number of inflammatory changes in the lungs seems to increase as sample weight pyrolyzed increases. Sacrificed animals have a greater incidence of inflammatory changes in the trachea than do the animals dying in the chamber.	The animals exposed to higher sample weights show more inflammatory changes in the trachea and higher incidence of erosion than those exposed to lower sample weights. There were no observable trends in lungs histopathology.	The animals exposed to higher sample weights were generally found to have a greater number of pulmonary lesions than those exposed to lower sample weights. Especially notable is the increases in severity of atelectasis, congestion, and edema with exposure to pyrolysates formed from increasing sample weights.
Gross Autopsy	The lungs of sacrificed animals were generally more gray in color having a greater proportion of dark red spots on the surface of each lobe, and the liver of these animals were generally more dark brown in color, when compared with animals that died in the chamber. Animals dying during the 14-day observation period consistently displayed pallor, inactivity with little or no response to manual displacement, and felt abnormally cool to the touch for 24 to	Y-7684 Vonar The lungs of autopsied animals were 3 on Fiberglass generally light brown in color with dark brown or red-brown spots on the surface of each lobe.	The autopsied animals generally had red-brown spots on the surface of each lobe of the lungs and frequently displayed signs of congestion of the liver.
Sample Tested	Y-7683 LS 200 Foam	Y-7684 Vonar 3 on Fiberglass	Y-7685 Vonar 3 on N W Polyester

Table 13

General Summary of Gross Autopsies and Apparently Exposure-Related Histopathologic Features - In-Chamber Pyrolysis

	73		
Histopathologic Examination	Animals exposed to higher sample weights generally showed more congestion of heart and adrenal as well as hydropic change in the kidneys. Sacrificed animals presented more chronic conditions than did those dying in the chamber, especially in the trachea. However, there was no difference noted between these groups in the incidence or severity of pneumonitis. Atelectasis was determined to be more severe in the lungs of animals exposed to higher sample weights and the incidence of pulmonary edema was greater at sample weights of 3.94 grams or more.	Animals exposed to higher sample weights generally had a higher incidence of congestion in the heart, congestion and cloudy swelling in the kidneys, greater severity of tracheitis and atelectasis in the respiratory tract than did those animals exposed to lesser sample weights.	Sacrificed animals tended to have more chronic pulomonary inflammatory conditions than did those animals dying in the chamber, and the severity of atelectasis appears to have increased as sample weight increased. Animals dying in the chamber generally presented congestion of liver and kidneys while the sacrificed animals generally presented fatty change in the liver and cloudy swelling with hydropic change in the kidneys.
Gross Autopsy	Lungs of all animals were generally healthy pink in color, lightly speckled with red spots on the surface of each lobe. These spots were more prominent in sacrificed animals than in those dying in the chamber. Liver and kidneys frequently showed signs of congestion.	Lungs of all animals were generally healthy pink in color, lightly speckled with red spots on the surface of each lobe. The livers of animals dying in the chamber more frequently showed signs of congestion than did those of sacrificed animals.	All autopsied animals had red-brown spots on the surface of each lobe of the lungs. Animals dying in the chamber more frequently showed signs of congestion of liver and kidneys than did the sacrificed animals.
Sample Tested	Y-7683 LS Foam	Y-7684 Vonar 3 on Fiber- glass	Y-7685 Vonar 3 on N W Polyester

	PYROLYSIS PRODUCTS
	AND
	SHOCK
14	40
Table 1	ExPOSURE
	MLIM
	Experiments

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2,	ADRENAL	CONG/D/2	SN	7%%	Cone/A/D/2	2/0/4/5/2)	TRM	7NM	MME	WNL	WAL	WNC	WML	WNL	WNL	WNL	WNL	WNL	WNL	WWL	WNL	NW.	7WW
DING (LUNGS)	KIDNEY	THYR 10 /2	THYR/F/Z, MEDGAY	CONS/A/D/)	CONG/A/D/2	THYR/F/I	NS	MED CONG /A/I	MED CONG/A /1	MED CONS 14 12.	WNL	WNL	MED CONG/A/2	WNL	WNL	WNL	WNL	WNL	WNL	WW	MEDCONG/A/3	MED CONG 14/2	CLSW/1
DUMMARY (Exclud	SPLEEN	HYPF/D	MML	WNL	CONG/A/D/1	WNL	WNL	WWL.	WNL	WNL	WAL	WNL	Pro Cong/A/2	WNC	WNL	WNC	WN	WNL	WNL	WNC	WML	WNL	WNL
HISTOPATHOLOGY SUMMARY (EXCLUDING LUNGS)	LIVER	FTCH/0/2_	CONG /A/C/3	CONG/A/F/I FTCH/D/I	CONG/A/D/L FTCH/D//	CONG/A/D/1, FTCH/ D/1, INFL/C/F/1	CONG/A/D/Z, FTCH/F/I	CONG/AID/I	CONG/A/D/2.	CONG/A/D/1	WNL	CONG/A/D/I	CONG/A/D/2-3	WNL	WNL	FG/0/1-2	FTCH /D/2	FTCH/D/1	WNL	WNC	WWC	CONG /A/D/1	F-G4/P/2
į	I KACHEA	7WW	TRCH/C/F/1	TRCH/D/2	TRCH /C/D/2	Prec /F/1	Tex+16/0/2-3	TRC4/C/D/1-2	MNL	MNL	Тёсн/с/р/1	MNL	WNL	TRCH/C/D/1	TRCH /C/D/1	WNL	ERSH TRCH / C/D/2	TRCH/C/D/1	ERSN /F	TRCH/C/F/1-2	TRUH /C/D/2	WNL	TRCH/C/D/1
RS ON FIBER	HEAKI	WNL	MYOC ED/ F/1	COKO (ED / A/1	WNL	CONG/A/F/I	MYOC CONG (ED/D/2	WNL	NW	NNT	WWL	WNL	WNL	WNL	WNL	WNL	WNL	WN L	WNL	WNL	WNC	WWL	WNL
Y-7684 (VONARZ ON FIBERGLASS)	Garams) Devise	13434 15.00 CHAMBER	13433 20,00 CHAMBER	13459 20.00 CHAMBER COND (ED/A/1	346020.00 CHAMBER	1346120.00 CHAMBER CONG/A/F/1	1346220.00 CHAMBER MYOC GAIS TED/D/2 TEXH/C 1012-3	13475 15.00 CHAMBER	13476 15.00 CHAMBER	13477 5.00 CHAMBER	13478 20.00 SARIFICE	13471 20,00 CHAMBER	1347220.00 GIAMBER	1348520.00 SARIFICE	13481 15.00 skrifte	13482 15.00 SACRIFICE	13485 15.00 svcrince	13484 15.00 SACRIFICE	3479 20.00 SACRIFICE	1348020.00 SACRIFICE	347320.00 CHAMBER	1347420.00 CHAMBER	1348620.00 SACRIFICE
Y-76	W (V)	\$ 13434	五 13433	y 13459	# 13460	₹ 13461	113462	13475	13476		§ 13478			13485	13481	13482		£ 13484		2 13480		13474	113486

KEY: A=ACUTE, C=CHRONIC, D=DIFFUSE, F=FOCAL, R=REMOTE, I=MILD, 2-MODERATE, 3=SEVERE, NOTE: REFER TO LIST OF ABREVIATIONS USED IN HISTOPATHOLDGY SUMMARIES

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BUNYIOR WITH SHOCK

Table 14 (cont.)

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PYROLYSIS PRODUCTS SHOCK AND Exposure HLIM EXPERIMENTS

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PYROLYSIS PROCEDURE Brow/Ferrans freenown Little Cartils		C/F/2	1	C/F/I	F/2	z/p/z	1/0/:	1	C/F/I	:/F/i	/F/I-2	/F/I	/F/I	1	:/F/2	:/F/2	-	JF/2	JF/1	1/-4/:	/F/2	1/1/1
PYRC ENBEOW H) —		<u>)</u>		c/b/z c/b/z	1/a/> 1/a/>	c/F/I	c/E/l	c/F/I <i>c/F/</i> I	C/F/I-2\C/F/I-2	c <i>/F/</i> 1 <i> C/F/</i> 1	C/F/I C	1	C/F/2 C/F/2	c/ <i>F/</i> 2 c <i>/F/</i> 2	-	C/F/2 C/F/2	JF/1 C/F/1	c/F/1 c/F/	C/F/2 C/F/2	C/F/1 C/F/1
CHAMBER PYROLYSIS PROCEDURE. INFLANT PERBENY FREURINS MELINANTALIFICATION FOR INCLURAL PROCEDURE.	<u>'</u>			1	-) 	<u>၂</u>	1	ე —	<u>ာ</u>	<u>(</u>	၁ —) —	-	<u>)</u> —	<u>၂</u>		<u></u>	<u> </u>	<u> </u>	<u> </u>	의
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(LUNGS ONLY) TION EDEMA EMPHY- NEW EDEMA		F/2-3 a	A/F/2	A/F/2 [F/3 .	A/F/2	A/D/2	A/D/3	A/b/2	A/F/I	A/F/I	A/D/2-3	A/F/3	 	A/F/2	A/F/I	A/D/5	A/b/2	A/D/2 -	A/F/2 F	A/D/1	AIF/3
Y (Lune) BILATION EI BEÖNCH		<u> </u>	H		<u>-</u> 	— A		<u> </u>	A		— 	— A	A —	1	— A				_ A	A	<u> </u>	¥
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ATHOLOGY SUMMARY (LUI) BRONCHO-ONICESTION DILATION HITS PHEUMONA ONICESTION DEONICH		<u>L</u>	<u> </u>	A		<u> </u>	C/F/2 A/D/2	<u> </u>	— A		— A	- R	— A,	C/F/I A.	— A	<u> </u>	— A	1F/23 A/D/2	A -	.— A	<u> </u>	
DPATHOU]	-	- 1/3/0	_	.	-	<u>ر</u> ا	-	:/F/2 -					C,	A/F/2 -	1		C	1	E/I	C/F/2	<u>'</u>
HISTOPA BRONCHI-BRONCH	-'-	_	<i>c/E/</i> 1 C		-	1		<u> </u>	D/2-3 AKC/F/2/AKC,		<u> </u>	1	-	1	A	1	-)	— AF	<u> 3</u> -	1
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Y-7684 (VONARZ ON FIBERGLASS) SAMPLE SAMPLE DEATH ABSCESS ATELEC-	13434 15 00 CHAMBER	3433 20 00 CHAMBER	3459 20 00 CHAMBER	13460 20 00 CHAMBER	13461 20.00 CHAMBER	13462 20 00 CHAMBER	1347515.00CHAMBER	13476 15,00 CHAMBER	13477 15 00 CHAMBER	13478 20 00 SACKIFICE	13471 20.00 CHAMBER	13472 20.00 CHAMBER	13495 20 00 SKRIFKE	13481 15.00 SKRIFICE	13482 15.00 skripte	13483 15.00 SACRIFICE	13484 15.00 SCRIFICE	13479 20.00 SACRIFICE	13480 20,0054CRIFICE	15475 20,00 CHAMBER	13474 20.00 CHAMBER	13486 20.00\sque
	7017	MH36		1201	_	_				OHS		./M					юн			נדאכ		\exists
(P)												(3)										

WITHOUT SHOCK

1=mild, 2=moderate, 3=severe, 4=mussive NOTE 1: A DASH INDIGATES THE LESION WAS NOT. OBSERVED IN THAT ANIMAL. Key: A=Acute, C=CIRONIC, D=DIFFUSE, F=FOCAL, R=REMOTE,

REFER TO LIST OF ABREVIATIONS. LISED IN HISTOPATHOLOGY NOTE 2:

Table 15

General eaturesExp	Summary of Gross Autopsies and Appare loratory Studies with Pyrolysate - Ex	General Summary of Gross Autopsies and Apparently Exposure-Related Histopathologic eaturesExploratory Studies with Pyrolysate - Exposure plus Shock [In-Chamber Pyrolysis
Sample Tested	Gross Autopsy	Histopathologic Examination
Y-7684 Vonar 3 on Fiber- glass	There were no grossly observed differences between animals receiving shock and those not receiving shock during exposure. Dark red spots were consistently observed on the surface of each lobe of the lungs in all animals.	Those animals receiving shock during exposure when compared to those not receiving shock tended to have more congestion especially in the liver and kidney but also in the heart, adrenal and spleen. No differences were noted between these groups in pulmonary disorders.
Unexposed Controls	Control sacrifices consistently presented a light red speckling of the surface of each lobe of the lungs. The lungs were generally a healthy pink color.	Control animals show a significant number of pulmonary lesions but generally less severe than those found in experimental group.

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Three rats in shock chamber exposed to pyrolysates of Y-7684 In-Chamber Pyrolysis and Shock Table 16

Sample Wt.	20 gm	20 gm	
Group	50	51	
Cumulative Mortalityb	3/3, 3/3, 3/3	3/3, 3/3, 3/3	
% Pyrolyzed	52	52	
× conb ^c	83%	73%	
0 ₂ (GC) ^d	20.1/20.8/20.8	19.6/18.9/17.2	
co ² (cc) ^d	1.10/1.26/1.02	1.06/1.16/1.08	
p(39) 03	0.23/0.24/0.18	0.22/0.21/0.19	
e co e	0.5%	0.6%	
e 00	0.1%	0.1%	
H ₂ 0e	6 mg/1	nt	
HCNe	40 ppm	45 ppm	
HFe	>20 ppm	>20 ppm	
HC1 e	200 ppm	400 ppm	
a Number b Morta	Number in parentheses indicates percent of Mortality expressed as number of animals	egrada dying	tion by weight. in chamber, within 48 hours, and within

14 days per number of animals exposed.

c Carboxyhemoglobin analyses were performed only on animals dying in the chamber. d GC samples were taken immediately, at 15 and at 30 minutes after combustion/pyrolysis and data indicate percent by weight at these times. e Measurements made with detector tubes manufactured by Gastec Corp., Tokyo, Japan.

These trial runs were conducted because of death of some trained rats to pyrolysates of this sample when similar exposures during the LDs studies were not lethal to the exposed rats. ORIGINAL PAGE IS OF POOR QUALITY.

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Table 17

A CONTRACTOR OF THE CONTRACTOR

Summary of results from simulataneously exposing 4 rats to in-chamber pyrolysis of Y-7684. During exposure 2 rats received shocks in the behavior apparatus while the other 2 did not receive shocks.

15 gm 20 gm 20 gm 55 52 53 55 52 53 3 (2/2) 1/2, 2/2, 2/2, 2/2 6/2, 1/2, 1/2 2/2, 2/2, 2/2 2/2 3 (2/2) 1/2, 2/2, 2/2 0/2, 0/2 0/2, 0/2, 0/2 2/2, 2/2, 2/2 2/2 5%, 20.5% 10.4%, 18.6% 19.9%, 18.9%, 19.1% 18.4%, 18.4%, 18.2% 5%, 20.5% 20.5%, 19.4%, 18.6% 19.9%, 18.9%, 19.1% 18.4%, 18.2% 23%, 0.2% 0.28%, 0.28%, 0.28%, 0.74% 0.17%, 1.26%, 1.19% 28 0.28%, 0.22%, 0.21% 0.10%, 0.10%, 0.10% 0.75% 0.31% 5% 0.1% 0.1% 0.75% 0.35% 5% 0.1% 0.1% 0.25% 0.35% 7/1 13 mg/1 10 mg/1 7/1 42 ppm >20 ppm >20 ppm 9m >20 ppm >20 ppm >20 ppm 9m 110 ppm 100 ppm 100 ppm 100 ppm 100 ppm 100 ppm					- L	E 00
e 15 gm 17 gm 10 gm 11	-				20 gm	
with 2/2, 2/2, 2/2 55 52 2/2, 2/2, 2/2 with 2/2, 2/2, 2/2 1/2, 2/2, 2/2 2/2, 1/2 2/2, 2/2, 2/2 2/2, 2/2, 2/2 with- 0/2, 0/2, 0/2 0/2, 0/2, 0/2 0/2, 0/2, 0/2 2/2, 2/2, 2/2 2/2 2/2 with- 0/2, 0/2, 0/2 0/2, 0/2 0/2, 0/2 2/2 2/2 2/2 2/2 10ck 1 19.1%, 20.5%, 20.5% 20.5%, 19.4%, 18.6% 19.9%, 18.9%, 19.1% 18.4%, 18.4%, 18.2% 10c. 1 1 1 2 <	0 - t	15 gm			73	56
s with 2/2, 2/2, 2/2 1/2, 2/2, 2/2 1/2, 2/2, 2/2 2/2, 1/2 2/2, 2/2, 2/2 2/2, 2/2, 2/2 s with- 0/2, 0/2, 0/2 0/2, 0/2, 0/2 0/2, 0/2, 0/2 2/2, 2/2, 2/2 2/2, 2/2 2/2 s with- 0/2, 0/2, 0/2 0/2, 0/2, 0/2 0/2, 0/2 0/2, 0/2 2/2, 2/2 2/2	7 116	5.4	55	52		6/1 0/1
s with 2/2, 2/2, 2/2, 2/2 1/2, 2/2, 2/2 1/2, 2/2, 2/2 2/2, 2/2 2/2, 2/	1			0/2, 1/2, 1/2	2/2, 2/2, 2/2	0/2, 1/2, 1/2
s with- hock 15,30 0/2, 0/2, 0/2 0/2, 0/2, 0/2 0/2, 0/2, 0/2 0/2, 0/2, 0/2 0/2, 0/2, 0/2 15,30 19.1%, 20.5%, 20.5% 20.5%, 19.4%, 18.6% 19.9%, 18.9%, 19.1% 18.4%, 18.6%, 18.2% nc. 15,30 1.37%, 1.76%, 1.51% 0.74%, 0.80%, 0.88% 0.41%, 0.58%, 0.74% 0.17%, 1.26%, 1.19% nc. 1,15,30 0.23%, 0.23%, 0.23%, 0.23% 0.22%, 0.21% 0.10%, 0.10% 0.17%, 1.26%, 1.19% nc. 1,15,30 0.23%, 0.23%, 0.23%, 0.23% 0.25% 0.10% 0.10% 0.15% nc. 1,15,30 0.23%, 0.23%, 0.23% 0.23%, 0.25% 0.10% 0.10% 0.32%, 0.32%, 0.31% Tube 1.0% 0.1% 0.1% 0.1% 0.1% 0.25% Tube 47 ppm 42 ppm 37 ppm 50 ppm 100 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm 100 ppm	ths with	2/2, 2/2, 2/2	67/53	010 010 010	2/2, 2/2, 2/2	0/2, 1/2, 1/2
30) 19.1%, 20.5%, 20.5%, 20.5% 20.5%, 19.4%, 18.6% 19.9%, 18.9%, 19.1% 18.4%, 10.7%, 10.2% 19.9%, 18.9%, 19.1% 18.4%, 10.7%, 10.2% 19.9%, 18.9%, 19.1% 18.4%, 10.2% 19.9%, 19.1% 18.4%, 10.5% 19.9%, 19.1% 19.9%, 19.1% 19.9%, 19.1% 19.9%, 19.1% 19.9%, 19.1% 19.9%, 10.1% 19.9%, 10.1% 19.9%, 10.1% 19.9%, 10.1% 19.9%, 10.1% 19.9%	ths with-	0/2, 0/2, 0/2	2, 0/2,	0/2, 0/2	75 81 10 /01 18 25	19.25, 18.9%, 18.53
Conc. 1.37%, 1.76%, 1.51% 0.74%, 0.80%, 0.88% 0.41%, 0.58%, 0.74% 0.17%, 1.26%, 1.19% Conc. 0.15,30 1.37%, 1.76%, 1.51% 0.23%, 0.22%, 0.21% 0.10%, 0.10%, 0.10% 0.10%, 0.10% 0.37%, 0.32%, 0.32%, 0.31% Conc. 1.0% 0.23%, 0.22%, 0.21% 0.25% 0.25% 0.75% Conc. 1.0% 0.3% 0.25% 0.75% 0.75% Conc. 1.0% 0.1% 0.1% 0.25% Tube 9 mg/1 13 mg/1 10 mg/1 Tube 47 ppm 42 ppm >20 ppm >20 ppm Tube >20 ppm >20 ppm >20 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm Tube 75 ppm 110 ppm 67%	(0.15,30)	10 19 20 5%, 20.5%		19.9%, 18.9%, 19.1%	18.4½, 10.4½, 10.5%	0.000
(0,15,30) 1.37%, 1.76%, 1.51% 0.74%, 0.22%, 0.21% 0.10%, 0.10%, 0.10% 0.33%, 0.32%, 0.31% Conc. (0,15,30) 0.23%, 0.23%, 0.22%, 0.22%, 0.21% 0.10%, 0.10% 0.15% 0.75% Conc. 1.0% 0.23%, 0.23%, 0.22%, 0.22%, 0.21% 0.05% 0.75% 0.75% Tube 0.15% 0.1% 0.1% 0.1% 0.25% 0.25% Tube 9 mg/1 13 mg/1 10 mg/1 10 mg/1 Tube >20 ppm >20 ppm >20 ppm >20 ppm Tube >20 ppm >20 ppm 100 ppm Tube 47 ppm >20 ppm >20 ppm Tube 520 ppm 67% Tube 67% 67%	Conc.	13. 173 501.01	0 276 0 80% 0 88%	0.41%, 0.58%, 0.74%	0.17%, 1.26%, 1.19%	0.63%, 0.85%, 0.54%
(0,15,30) 0.23%, 0.23%, 0.23%, 0.22%, 0.21% 0.10%, 0.10%, 0.10%, 0.10% 0.15% 0.75% Conc. 1.0% 0.3% 0.25% 0.75% Tube 0.15% 0.1% 0.1% 0.25% Tube 9 mg/1 13 mg/1 10 mg/1 Tube 47 ppm 42 ppm >20 ppm >20 ppm Tube >20 ppm >20 ppm 100 ppm 100 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm 100 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm 100 ppm	(0,15,30) conc.	1.37%, 1.76%, 1.51%	0.74% 0.00% 0.00%	אָטן ט אָטן ט אָסר פּ	0.33%, 0.32%, 0.31%	0.15%, 0.13%, 0.13%
Conc. 1.0% 0.3% 0.25% 0.75% Tube 0.15% 0.1% 0.25% 0.25% Tube 9 mg/1 13 mg/1 10 mg/1 50 ppm Tube 42 ppm >20 ppm >20 ppm >20 ppm >20 ppm >100 ppm 100 ppm 110 ppm 110 ppm 100 ppm 110 ppm 1	(0,15,30)	0.23%, 0.23%, 0.23%	0.23%, 0.22%, 0.21%	0.10% 0.10% c.10%		0.950
Tube 0.15% 0.1% 0.25% Tube 9 mg/l 13 mg/l 10 mg/l Tube 47 ppm 42 ppm 37 ppm 60 ppm Tube >20 ppm >20 ppm 100 ppm 100 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm 100 ppm	Conc.	50 -	0 38	0.25%	0.75%	U. C3.0
Tube 9 mg/1 13 mg/1 10 mg/1 Tube 47 ppm 42 ppm >20 ppm >20 ppm Tube >20 ppm >20 ppm 100 ppm 100 ppm 100 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm		%O.1			0.25%	0.1%
Tube 9 mg/1 13 mg/1 10 mg/1 Tube 47 ppm 42 ppm 520 ppm >20 ppm >20 ppm >20 ppm Tube 75 ppm 110 ppm 100 ppm 100 ppm 1 Inber Death 64% 67% 67%	- 1	0 15%	0.1%	%1.0	2010	
Tube 9 mg/l 13 mg/l 13 mg/l 37 ppm 60 ppm 520 ppm 37 ppm 60 ppm 37 ppm 60 ppm 37 ppm		22.0	11 6.5		T/gm 0T	8 mg/1
t 47 ppm 42 ppm 37 ppm 67% t 42 ppm >20 ppm >20 ppm t >20 ppm 110 ppm 100 ppm t 75 ppm 110 ppm 67%	١.	1/gm 6	13 mg/ 1		man O	
20 ppm >20 ppm >20 ppm 3 >20 ppm 100 ppm 100 ppm 3 75 ppm 110 ppm 100 ppm 4 67% 67%	- 1	maa ZV	42 ppm	37 ppm	niidd no	
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a 75 ppm 110 ppm 100 ppm Death 64% 67%	1	>20 ppm	>20 ppm	dd 07/		100 mm
Death 64% 67% 67%	- 1		muu ULL	100 ppm	100 ррт	Ind ppin
Death 64% 67%		75 ppm	dd 011		67%	1
	amber Death	64%	67%			

Table 18

Means and Standard Deviations Averaged Across Groups for Two Daily Performances Prior to Behavior Test Expressed in Intervals of Ten Minutes

Intervals		Shocks Recei	ved Per Minute*
Warrander," Industrial Commission of Transcriptors (Insurance Commission Comm		Day 1	Day 2
#1	X	2.380	2.344
	σ	0.485	0.538
#2	X	2.178	2.061
	σ	0.686	0.717
#3	X	2.036	1.927
	σ	0,698	0.670
#4	X	1.925	1.983
	σ	0.727	0.612
# 5	X	1.908	1.794
	σ	0.727	0.689
#6	X	1.911	1.850
	σ	0.733	0.675
#7	X	1.918	1.761
	Ф	0.673	0.773

^{*} If rat did not press léver, it would receive 12 shocks per minute.

Summary of Mean Shocks Per Minute Received During Preburn, Burn, and Postburn Intervals for Each Sample At Each Exposure Level

			Annual Control of the
S. a Makadana Ab. ——		1e Y-7683	
	Group 1 (10 g.)	Group 2 (15 g.)	Group 3 (20 g.)
Preburn	$\ddot{X} = 1.933$ $\sigma = .310$	1.783 .682	1,883 .561
Burn	$\vec{X} = 2.100$ $\sigma = .626$	2.712 .712	1.900 2.672
Postburn	$\bar{X} = 3.877$ $\sigma = 1.692$	6.523 2.977	8.821 .836
	Samp	le Y-7685	
	Group 4 (10 g.)	Group 5 (15 g.)	
Preburn	$\bar{X} = 1.698$ $\sigma = .905$	2.967 .478	
Burn	$\bar{X} = 4.475$ $\sigma = 1.191$	3.112 .697	
Postburn	$\bar{X} = 9.207$ $\sigma = 1.769$	10.733 .874	
	Sam	ple Y 7684	
	Group 6 (5 g.)	Group 7 (10 g.)	Group 8 (15 g.)
Preburn	$\bar{X} = 2.092$ $\sigma = .624$	2.392 .421	1.575 .510
Burn	$\bar{X} = 1.725$ $\sigma = .432$	3.275 .311	3.450 1.765
Postburn	$\bar{X} = 3.458$ $\sigma = 1.310$	8.765 1.511	7.760 3.763
	Group 9 (20 g.)		
Preburn	$\bar{X} = 2.217$ $\sigma = .428$		
Burn	$\bar{X} = 3.942$ $\sigma = 1.397$		
Postburn	$\vec{X} = 9.405$ $\sigma = 1.128$		

Table 20

Newman Keul's Significance Matrix for Groups with Time Variables as the Variable, Factoring for Days (Matrices showing no significant difference have been omitted)

Note: * indicates 0.05 ** indicates 0.01

	Interval	Days	In	iterval	Days
Group 1	6	2 3	Group 3 (cont.)	7	2 3
	1	0.03 3,96 NS NS		1	0.91 48.30 NS **
	2	- 3.93 *		2	- 47.40 **
Group 2	5	1 3	Group 4	4	2 3
	2	0.03 6.69 NS **		1	0.32 5.21 NS *
	1	- 6.66 **		2	0.03 4.89
	6	2 3		5	2 3
	1	0.55 5.28 NS *		2	0.03 6.03 NS *
	2	- 4.73 *		1	- 6.00 **
Group 3	5	2 3		6	1 3
	1	0.58 14.11 NS **		2	0.58 15.98 NS **
	2	- 13.53 **		1	- 15.40 **
	6	2 3		7	2 3
	1	0.30 18.44 NS **		1	1.10 17.04 NS **
	2	- 16.14 **		2	- 15.93 **
			Group 5	4	1 3
		•		2	0.34 4.13 NS NS

3.80

Table 20 (contined)

Newman Keul's Significance Matrix for Groups with Time Variables as the Variable, Factoring for Days (Matrices showing no significant difference have been omitted)

Note: * indicates 0.05 ** indicates 0.01

	Interva]	Days		<u>. I</u>	nterv	<u>/a1</u>	Days	•
Group 5 (co	ont) 5		1	3	Group 7 (cont.)	6		2	3
		2	0.40 NS	11.66 **			1	0.00 NS	9.29 **
		1	#	11.27			2	>	9.29 **
	6		1	3		7		2	3
		2	0.44 NS	43.36			1	0.06 NS	20.24
		1	-	42.92 **			2	tus.	20.18
	7		2	3	Group 8	1		2	1
		1	0.00 NS	39.67 **			3	1.13 NS	4,84 *
		2		39.67 **			2	100	3.71 *
Group 6	No Signif	ican	t Diff	erences		5		1	3
Group 7	4		2	3			2	0.40 NS	4.24 NS
		1	0.00 NS	4.78 *			1		3.84
		2	-	4.78 *		6		1	3
	5		1	3			2	0.03 NS	4.26 NS
		2	0.20 NS	8.45 **			7	-	4.23
		1	0.00 NS	8.26 **					

Table 20(continued)

Newman Keul's Significance Matrix for Groups with Time Variables as the Variable, Factoring for Days (matrices showing no significant difference have been omitted)

Note: * indicates 0.05 ** indicates 0.01

	Interva	1	<u>Da y</u>	<u>s</u>
Group 8 (cont.) 7		1	3
		2	0.31 NS	4.53
		1	-	4.22
Group 9	4		1	3
		2	0.29 NS	4.52
		1	-	4.23
	5		1	3
		2	0.07 NS	5.29 *
		1	-	5.21 *
	6		1	3
		2	0,35 NS	29.69 **
		7	-	29.34 **
	7		1	3
		2	0.07 NS	26.91 **
		1		26.84

Table 23

Jabulation of Physical Parameters in Behavioral Studies

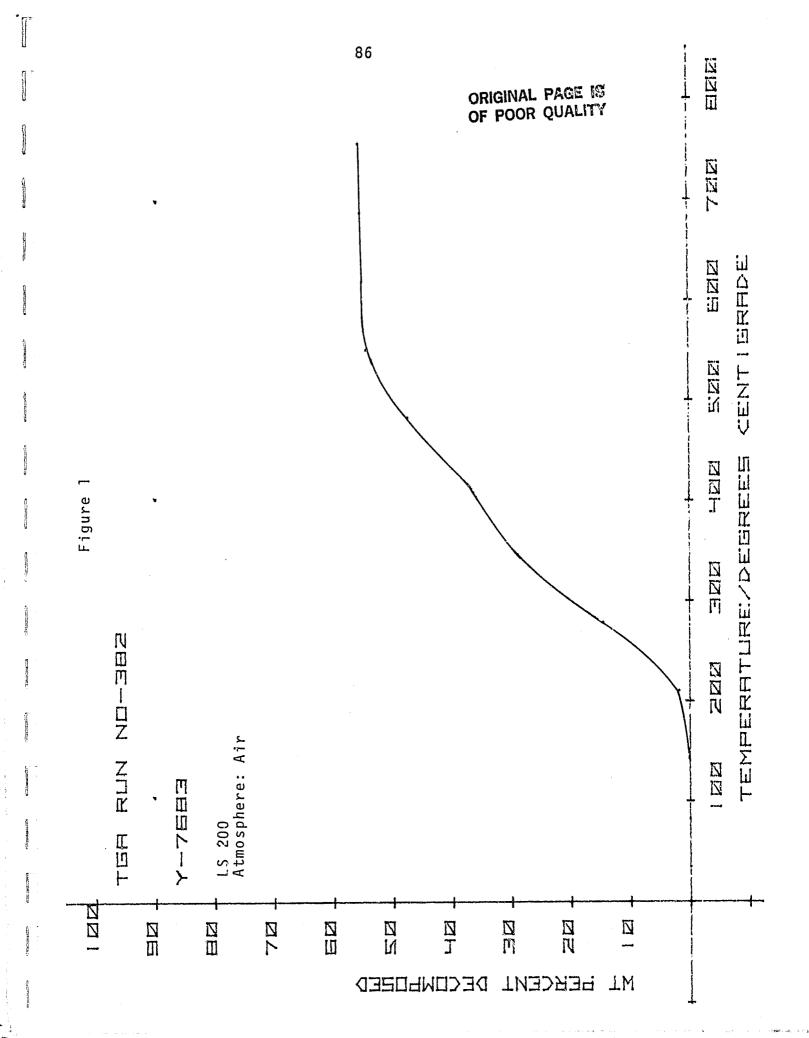
				Ó	emperat		
	Animal No.	Body Weight (am)	Chamber Temp.	Preheat	Initiation of Pvrolvsis	Final	2 Perolyzed
)	6) 2::6:2)) ;		:	
ron		9	6-36°	750	96	990	
Y-7683			8-36°	53°	62°	70°	
	38	340	25-35°C	770°C	ວຸ999	784°C	
		S	-35°	12°	。 90	章 らい	40
rou	01	475	5-36*	200	960	220	55
S	3	*	5-30°	805°C	86°	95°	56
5 gm		6	25-34°C	*	0.859	2777°C	٠.,
,	16	370	-34°	740°C	*	80ء	57
roup	14	456	5-35°		2	3,118	
Y-7683	15	3	26-35°C	50	92°	3	
G g		9	5-33°	250	14°	42°	
	က	/	4-33°	*	42°	و0 ہ	50
dno		∞	3-35°	000	78°	49°	
Y-7685		9	3-33°	00	510	12°	
0 9		335	23-34°C	ລ。908	99290	813°C	
	8	0	3-34°	00	8 8 9	010	65
Group 5	40	340	6-37°	25°	30°	36°	29
-76	37	2	24-35°C	ວ。008	2°907	825°C	29
		*	5-35°	50°	20 c	00	
		310	6-36°	50°	86°	00	

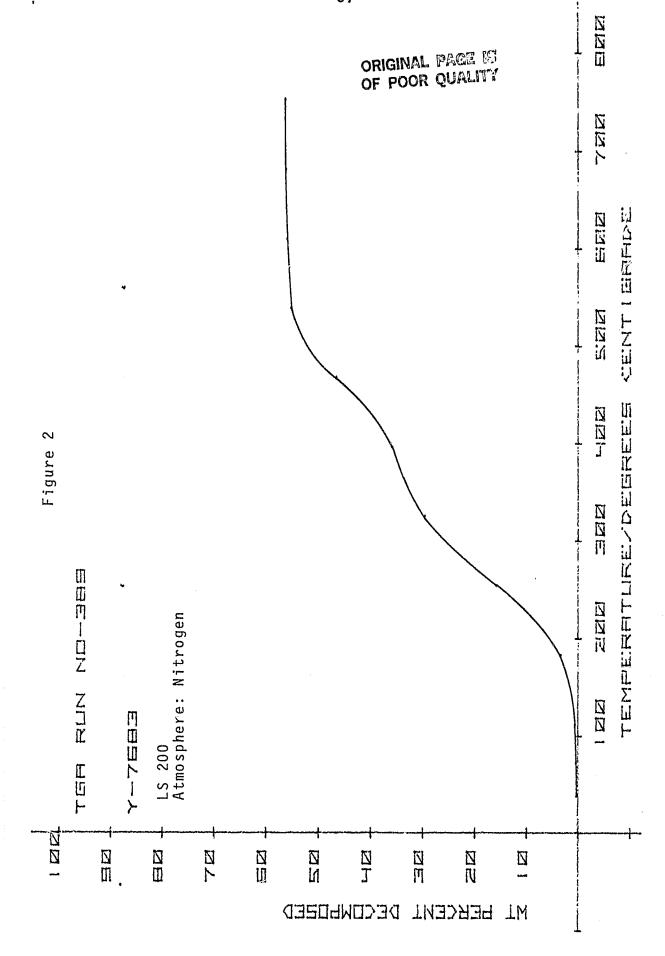
* Data not recorded.

Table 21 (continued)

	g Pyrolyzed	48	48	46	50	47	49	49	48	49	31	49	51	52	49	20	50
	Final	190	120	815°C	25°	00	10	829°C	05	05°	835°C	18°	43°	00	J°767	00	32
Temperatur	Initiation of Pyrolysis	86°	75°	ວ 829	29°	00 ه	86°	203°C	83°	643°C	*	٥	712°C	710°C	629°C	710°C	701°C
0ven	Preheat	270	80°	795°C	34°	50	5°	3,018	50	-10	3,018	2°	ွ	0	ຼລ。008	o N	ွ
	Chamber Temp. During Pyrolysis	7-36°	6-37°	26-36°C~	5-35°	6-37	6 - 37	26-35°C	6-36	96-36	27-37°C	6-36	5-35	5-35	24-35°C	5-35	8-38
	Body Weight (gm)	0	0		327	4	-	က	325	4	4		335	320	345	0	5
	Animal Nō.	27	30	28	.29	25	24	34	36	2	26	41	43	23	22	42	45
		roup	Y-7684	D		roup	Y-7684	0 g		roup	84	5 g		roup	Y-7684	0 0	

* Data not recorded.





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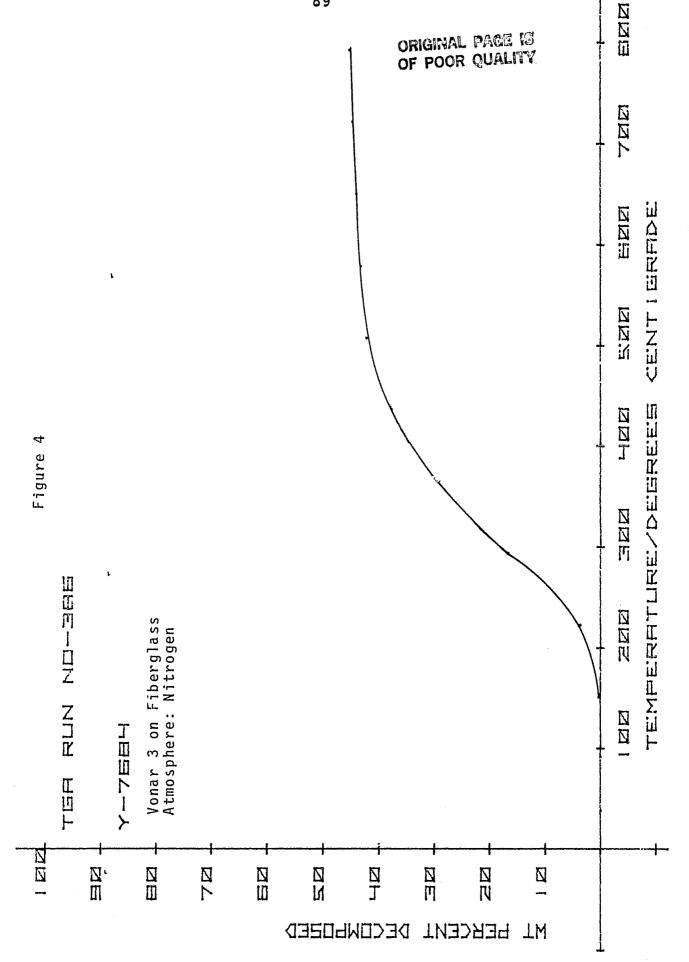
Figure 3

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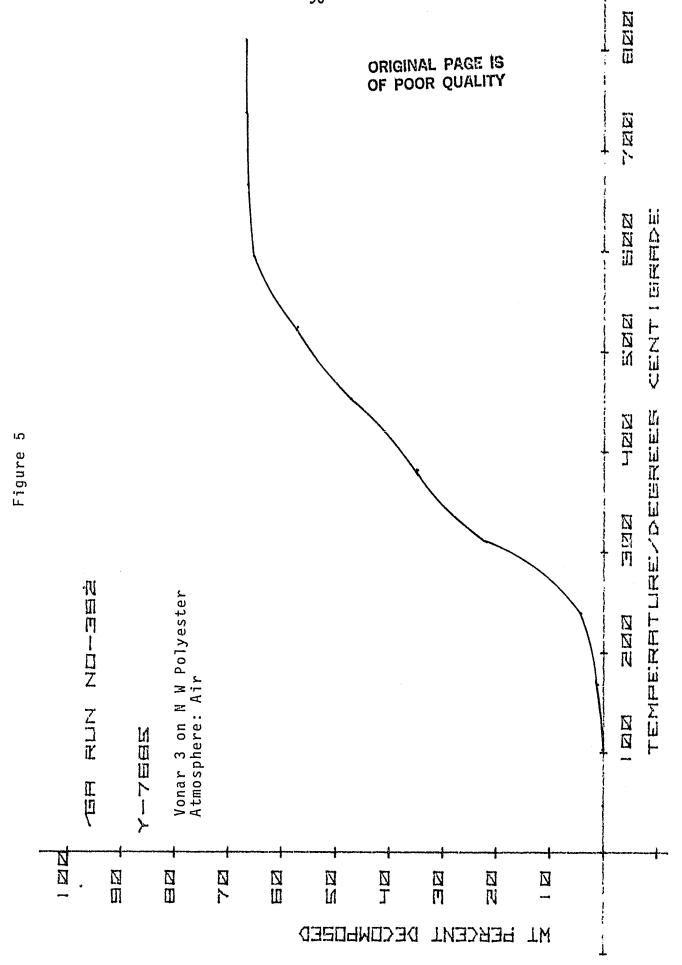
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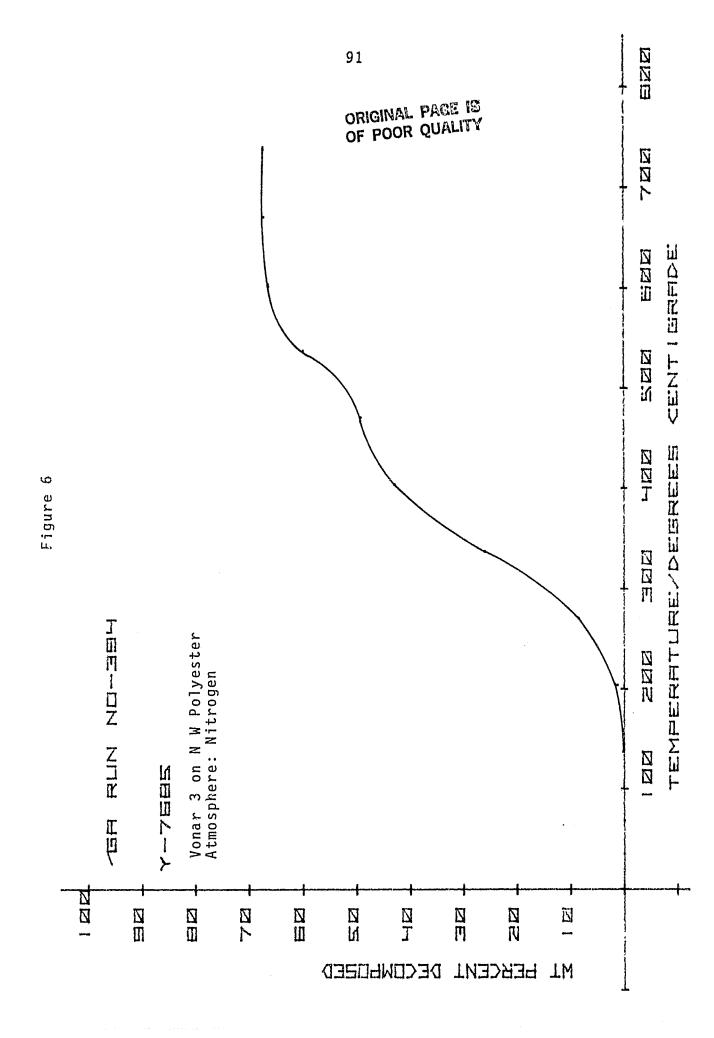
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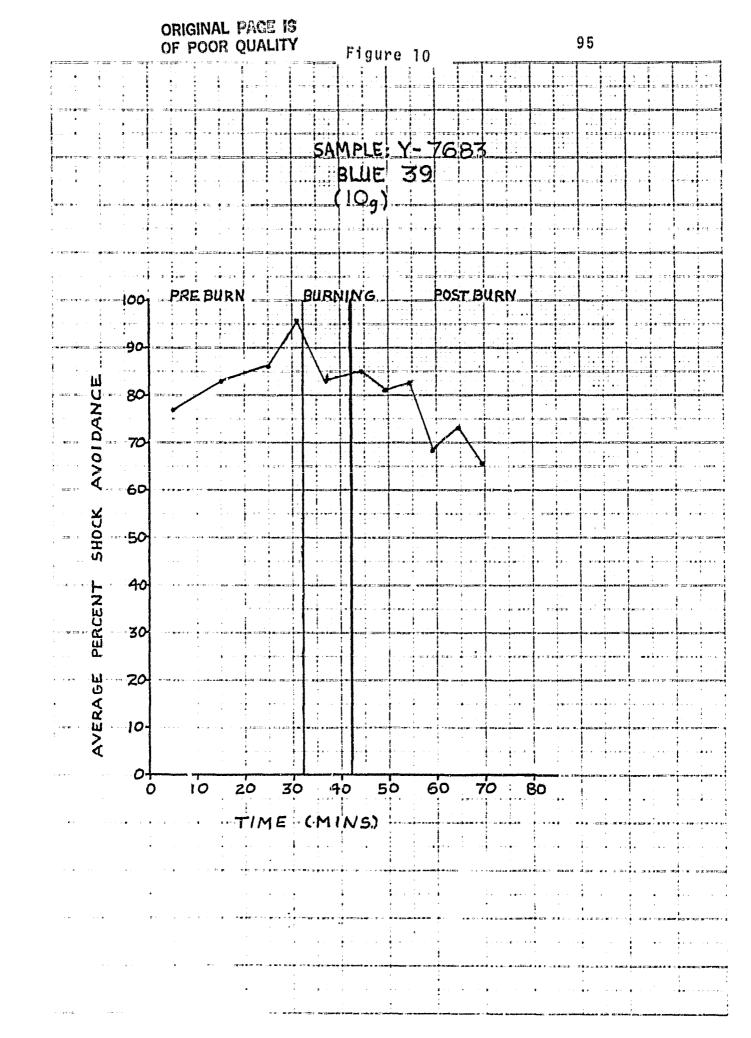
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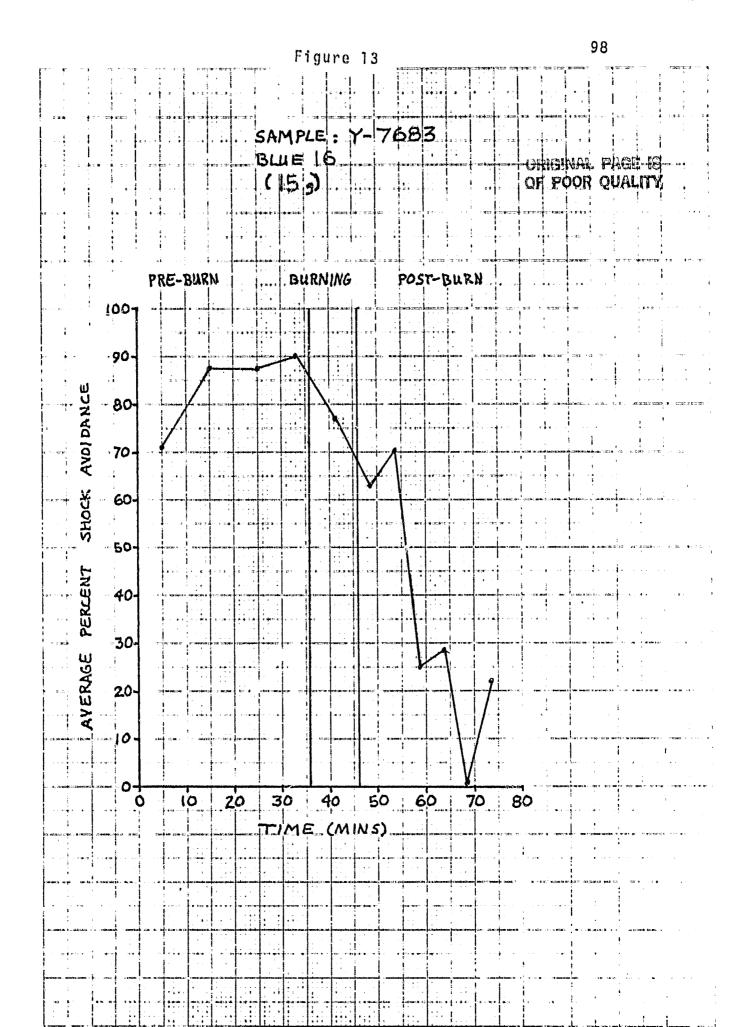


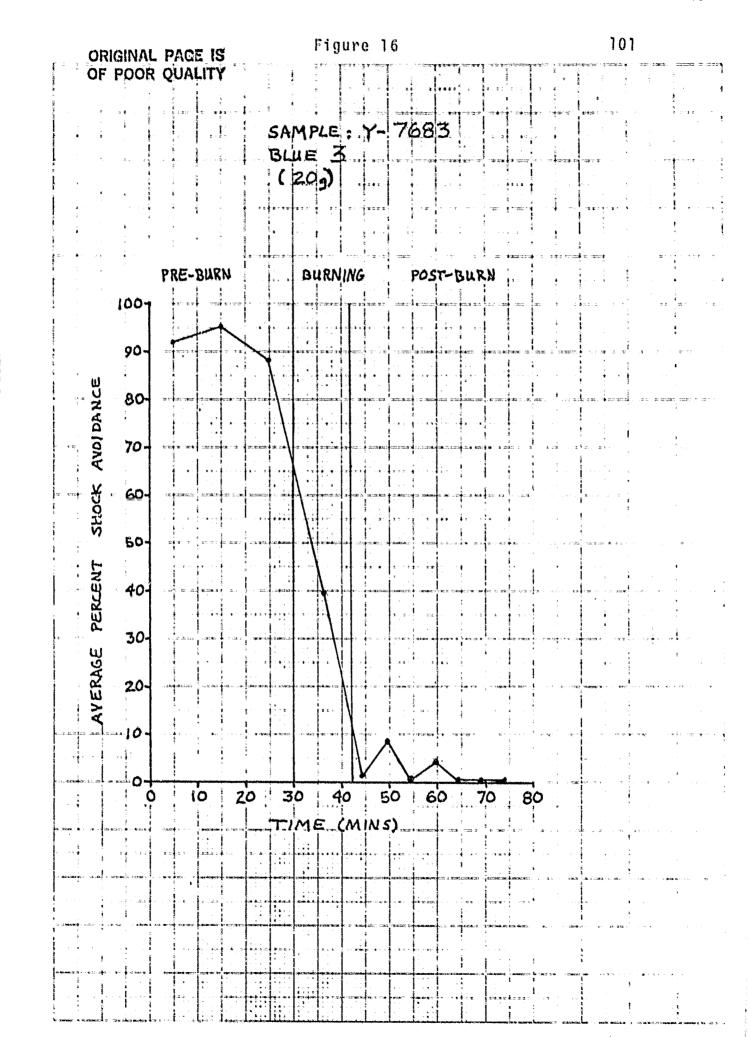




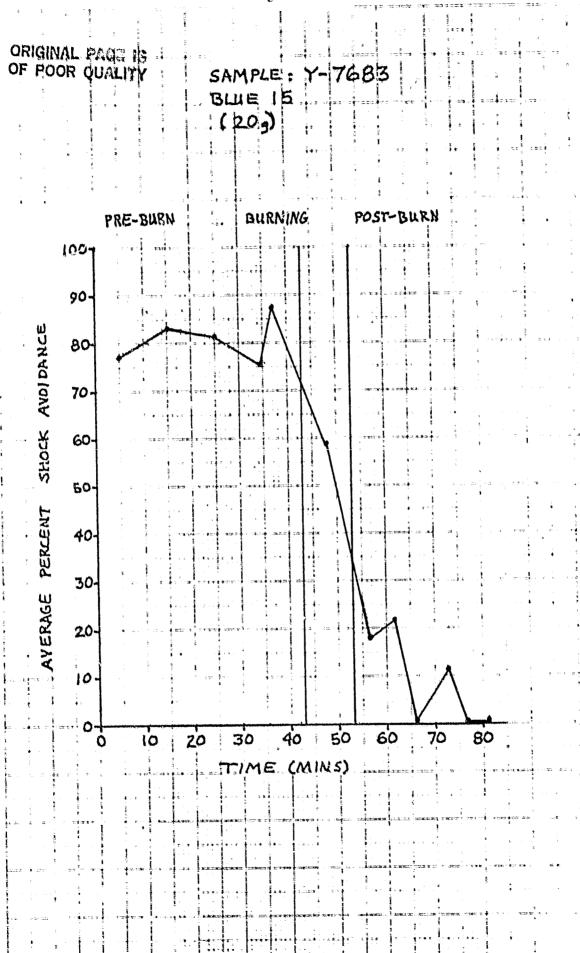


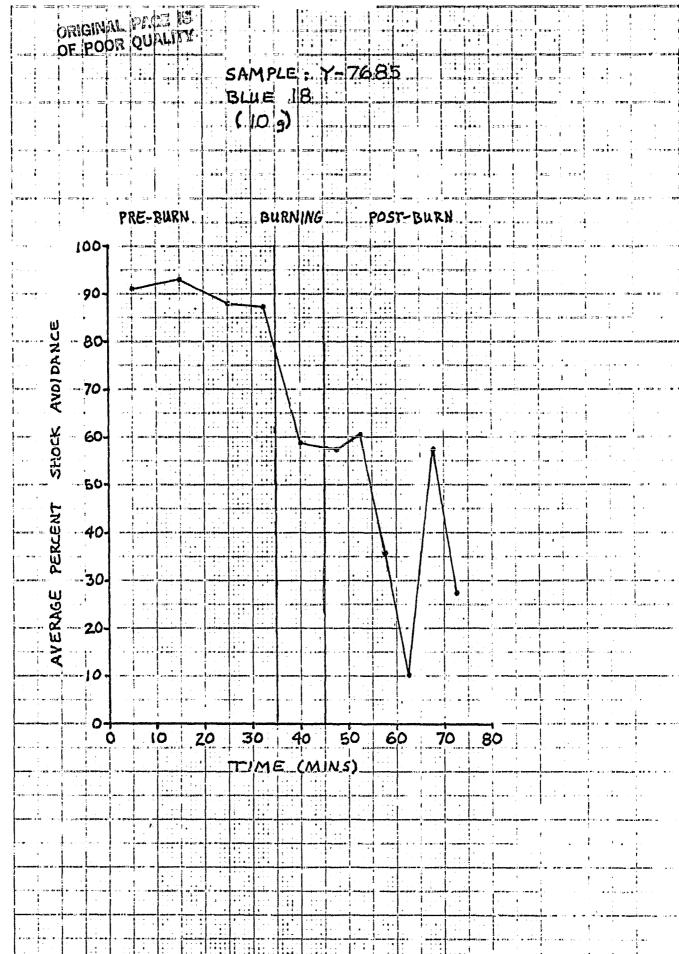
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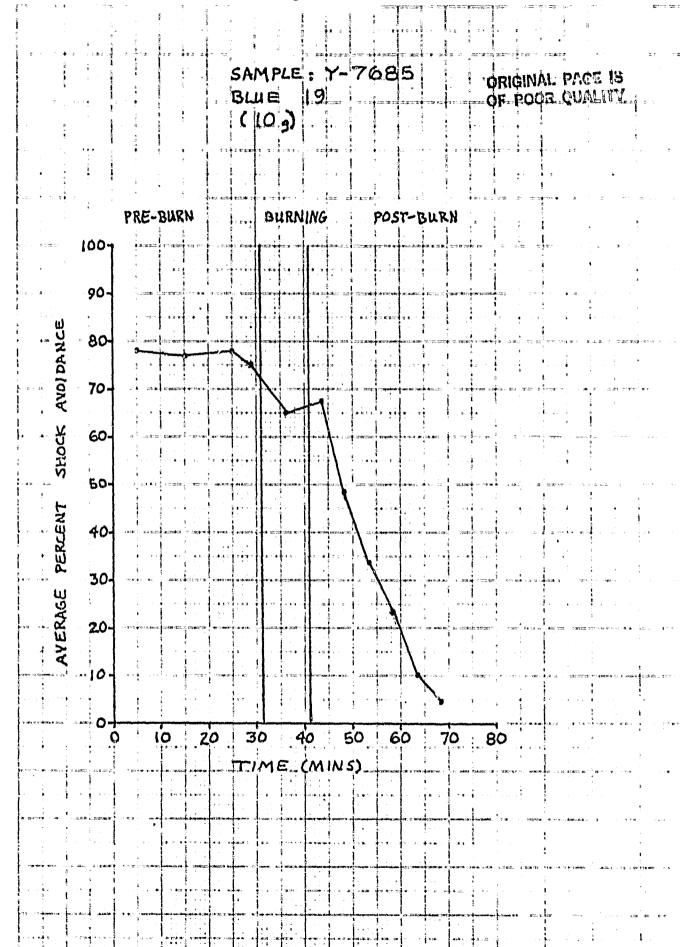


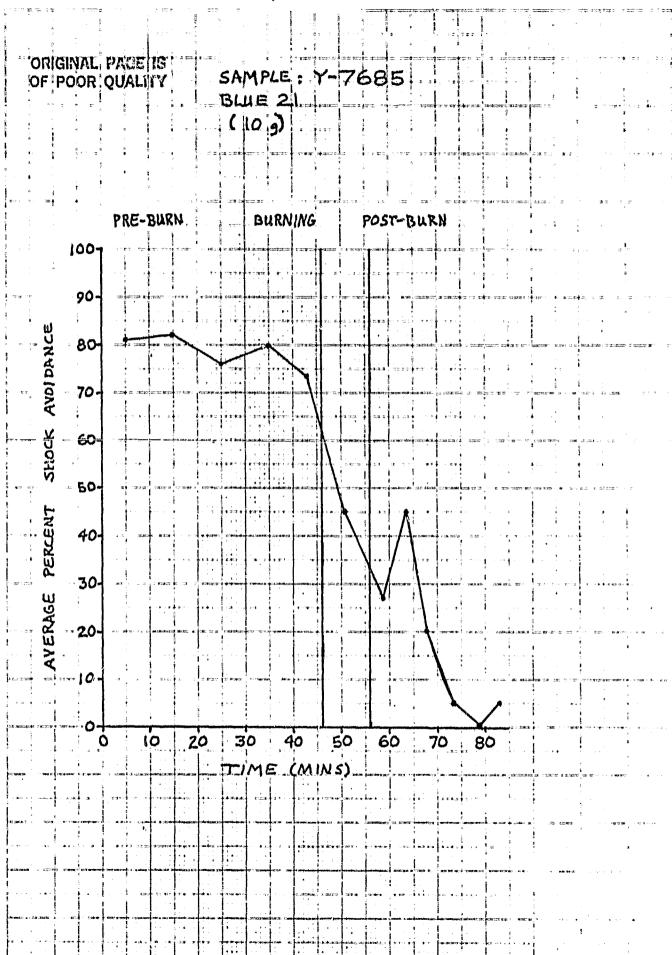
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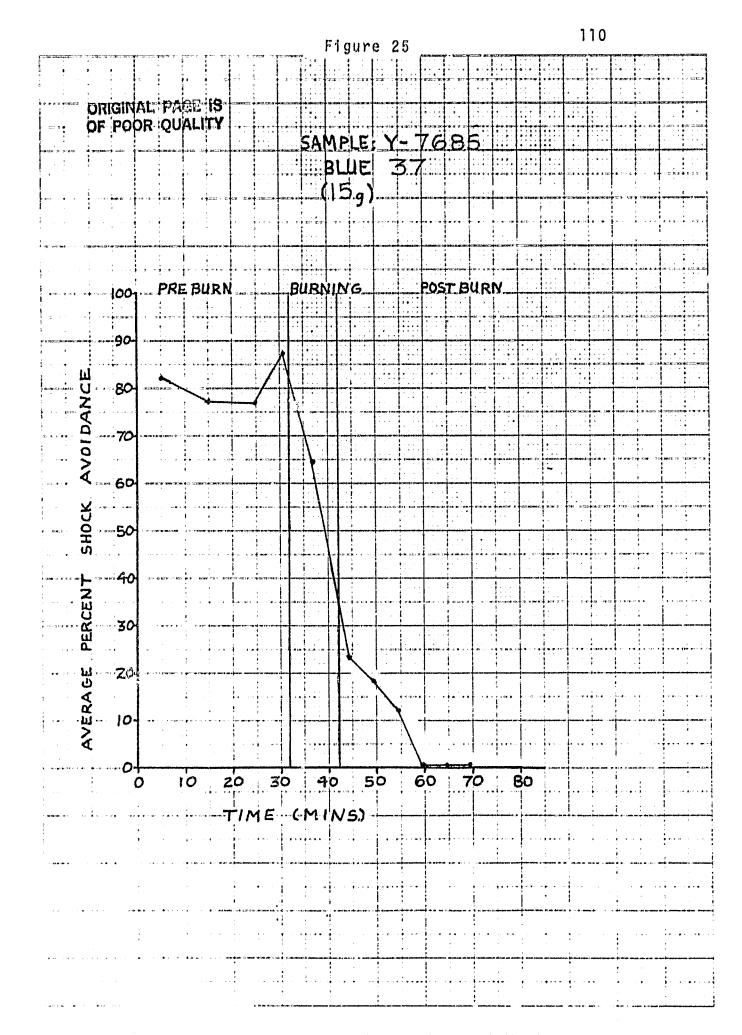




46 1320





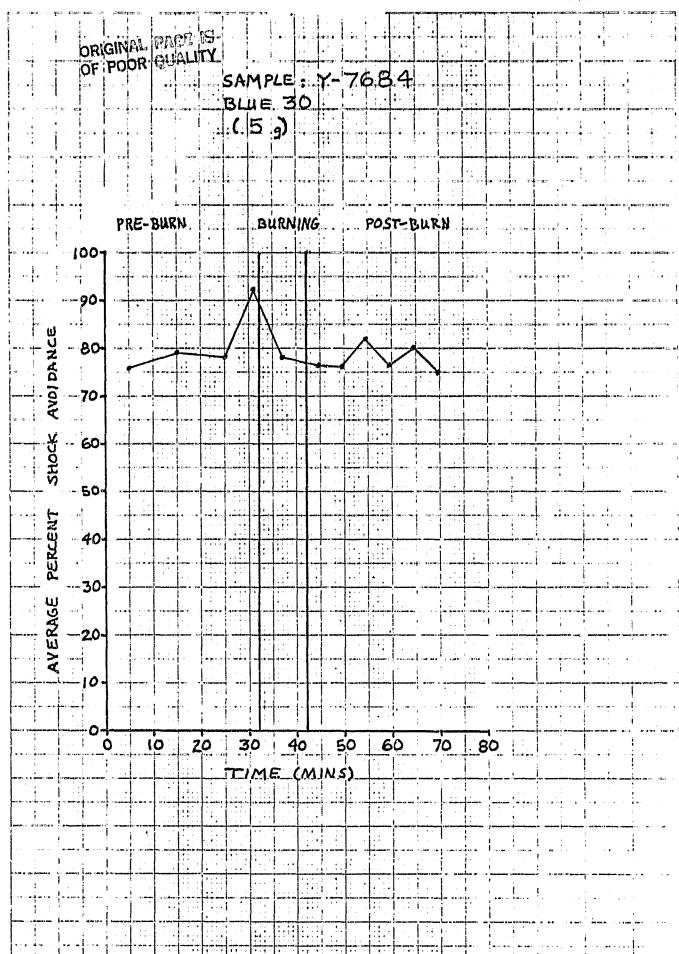


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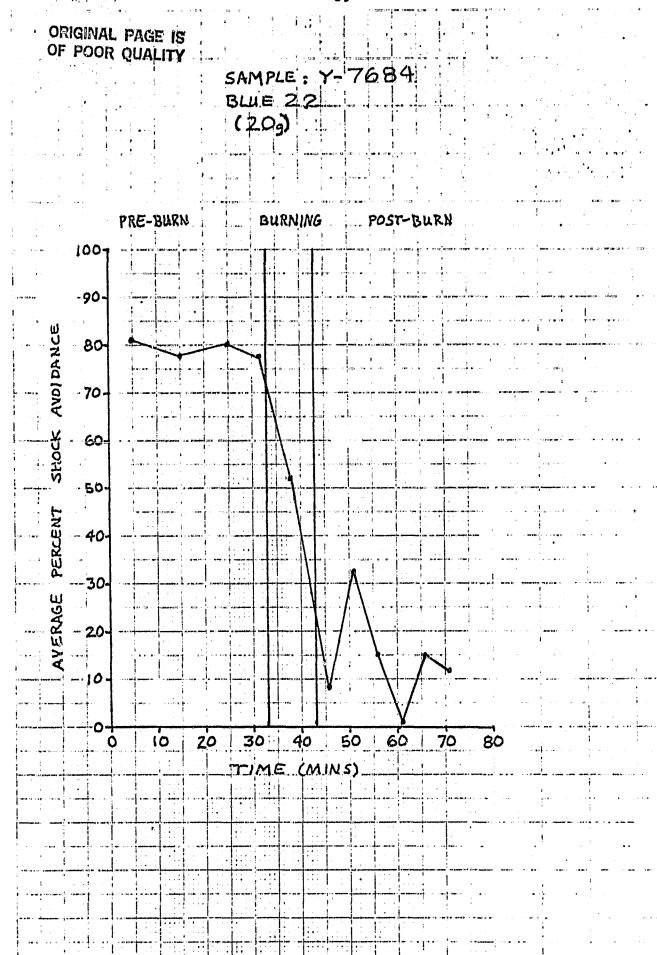
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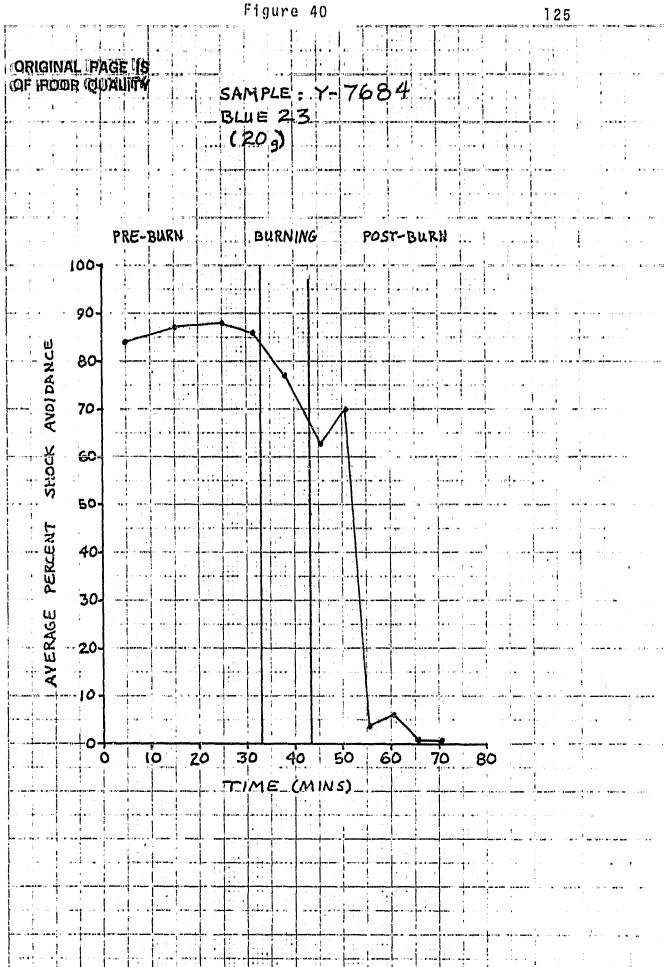


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Explanation of Pyrolysis-Behavior Responses: Group Summaries

Figures 43 through 51 summarize shock-avoidance behavioral activity of each group of rats exposed to pyrolysates of sample materials. The data are plotted as mean responses for the group of rats at each of the 7 time intervals. In these figures, the triangles show the baseline controls (i.e., the average of responses for the two tests, Days 1 and 2, preceeding actual exposure of rats to the pyrolysates). The other symbols, as defined on the figure, show the mean response of all animals in the group or sub-groups of the animals on the day of the pyrolysis-behavior test (Day 3). As before, the first 3 points represent responses preceeding the burn or pyrolysis phase, the 4th is the burn or pyrolysis phase, and the 5th, 6th, and 7th points represent responses for the 10 minute periods following pyrolysis (burn) of the sample.

Figure 43
Sample Y-7683
(10 grams)
Group 1

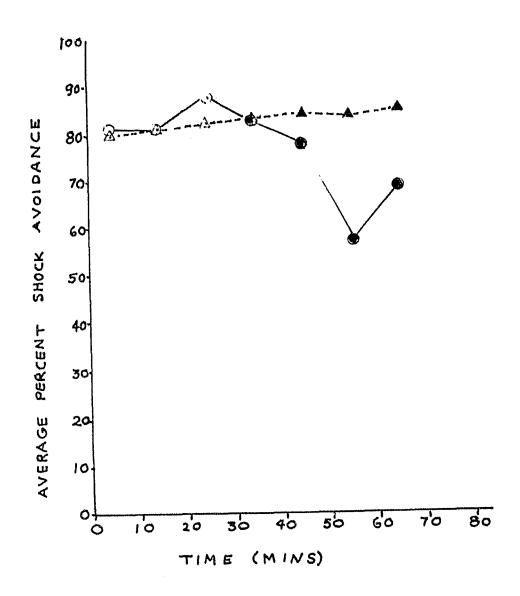


Figure 44
Sample Y-7683
(15 grams)
Group 2

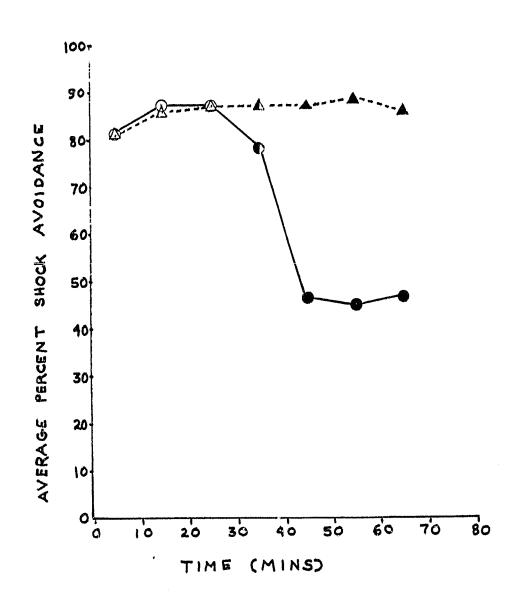


Figure 45 Sample Y-7683 (20 grams) Group 3

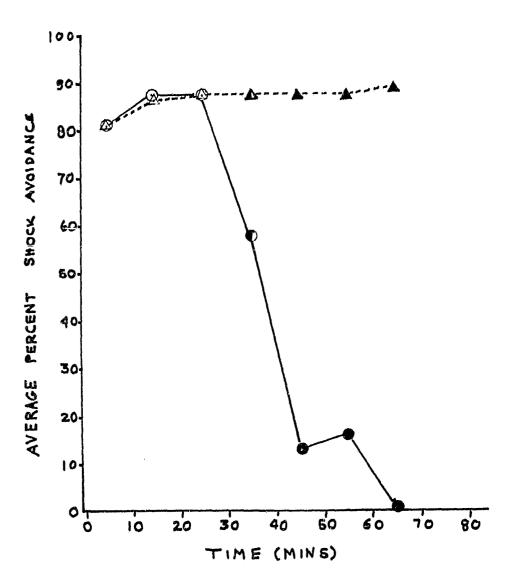


Figure 46 Sample Y-7685 (10 grams) Group 4

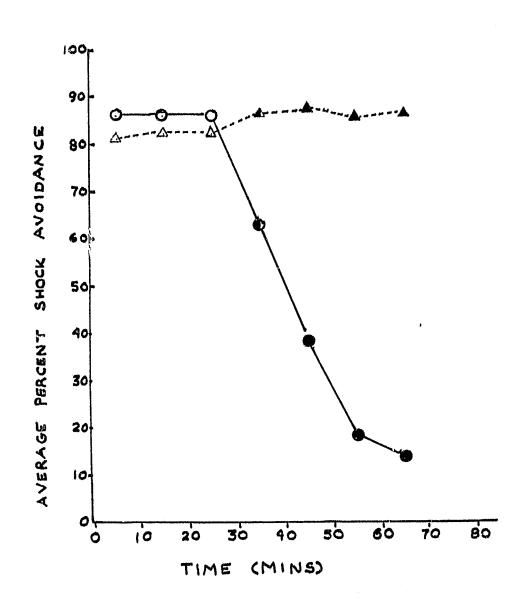
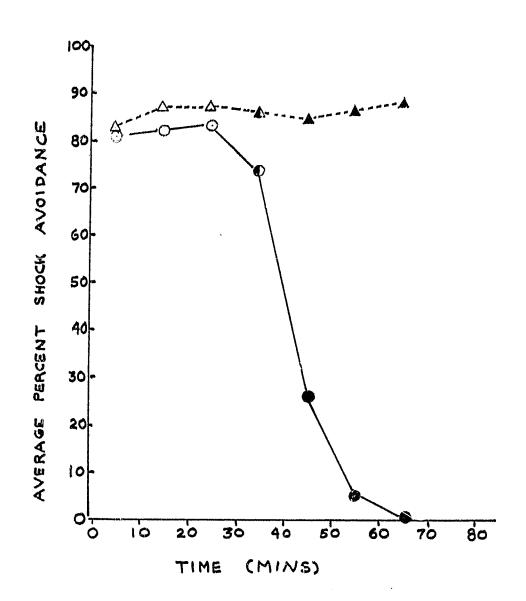


Figure 47 Sample Y-7685 (15 grams) Group 5



Averaged 2 day baseline, period corresponding to preburn.

Averaged 2 day baseline, period corresponding to burn.

Averaged 2 day baseline, period corresponding to postburn.

Test day, preburn period.

Test day, postburn period.

Test day, postburn period.

Figure 48 Sample Y-7684 (5 grams) Group 6

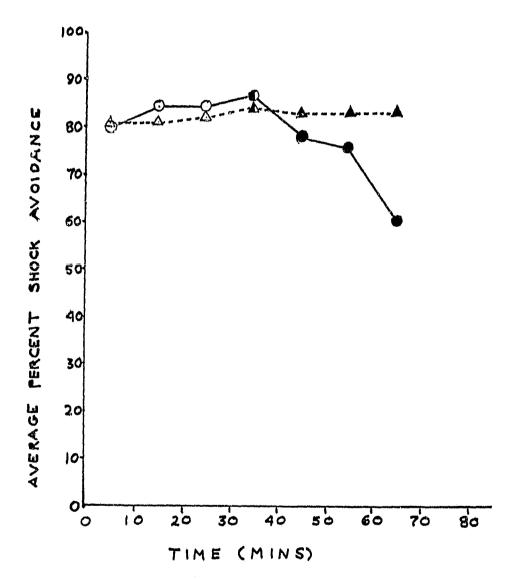
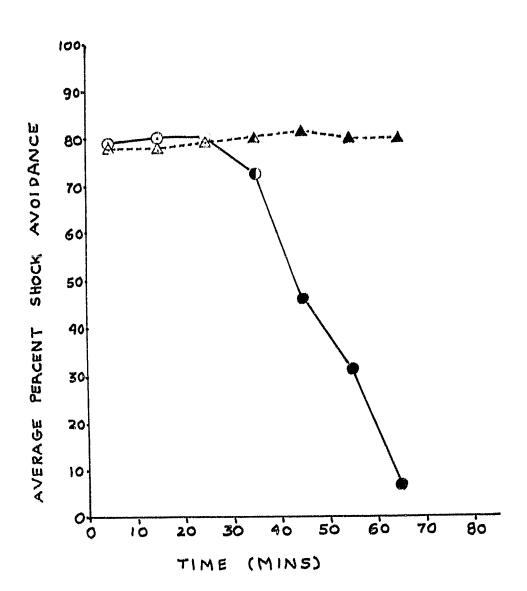


Figure 49
Sample Y-7684
(10 grams)
Group 7



Averaged 2 day baseline, period corresponding to preburn.

Averaged 2 day baseline, period corresponding to burn.

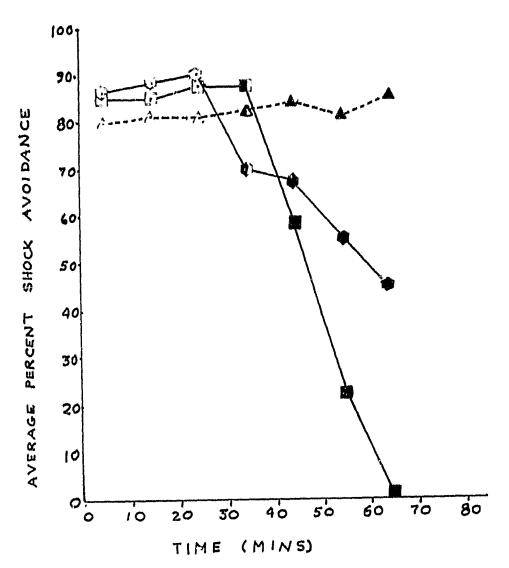
Averaged 2 day baseline, period corresponding to postburn.

Test day, preburn period.

Test day, postburn period.

Test day, postburn period.

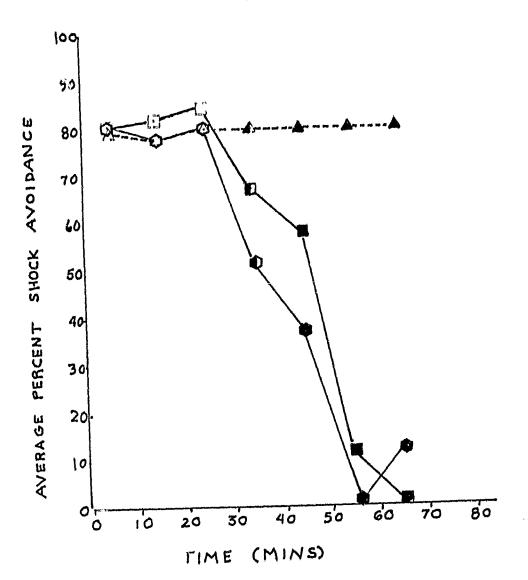
Figure 50
Sample Y-7684
(15 gm)
Group 8



Average 2 day baseline, period corresponding to preburn
Average 2 day baseline, period corresponding to burn
Average 2 day baseline, period corresponding to postburn
Test day, preburn period for animals surviving postburn
Test day, burn period for animals surviving postburn
Test day, postburn period for animals not surviving postburn
Test day, preburn period for animals not surviving postburn
Test day, burn period for animals not surviving postburn
Test day, postburn period for animals not surviving postburn
Test day, postburn period for animals not surviving postburn

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Figure 51 Sample Y-7684 (20 gm) Group 9



Average 2 day baseline, period corresponding to preburn
Average 2 day baseline, period corresponding to burn
Average 2 day baseline, period corresponding to postburn
Test day, preburn period for animals surviving postburn
Test day, burn period for animals surviving postburn
Test day, postburn period for animals not surviving postburn
Test day, preburn period for animals not surviving postburn
Test day, postburn period for animals not surviving postburn
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